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The Carman Lecture

TO COMMEMORATE the life and work of a great man by the establishment of a lectureship bearing his name is in a very special sense to keep his memory green. Not only does it recall from time to time his own accomplishments but it adds to them the luster of kindred achievements by his successors.

The Carman Lectureship of the Radiological Society of North America was founded in 1934 in honor of Russell D. Carman, and in that year the first of this series of distinguished lectures was given at the Twentieth Annual Meeting of the Society by Dr. Carman's successor as head of the Section on Roentgenology of the Mayo Clinic, Dr. B. R. Kirklin. Dr. Kirklin spoke on "The Roentgenologic Diagnosis of Gastric Cancer," a subject to which his predecessor had made substantial contributions.

The following year Dr. Arthur C. Christie, having been named as the second Carman Lecturer, took as his subject "Bronchiectasis: Its Diagnosis and Treatment." He was followed in 1936 by Dr. James T. Case, speaking on "The Field of Roentgenology in the Diagnosis and Treatment of Colonic Disorders," and in 1937 by Dr. George W. Holmes, on "The Development of Post-Graduate Teaching in Radiology." In 1938, another of Dr. Carman's associates at the Mayo Clinic, Dr. W. C. McCarty, Sr., was chosen for this honor.

Like Dr. Kirklin, he chose to speak on "Cancer of the Stomach." Subsequent lecturers and their subjects were Dr. Francis Carter Wood, in 1939, "The Biological Effects of Radiation;" Dr. Ross Golden, 1940, "Abnormalities of the Small Intestine in Nutritional Disturbances: Some Observations on Their Physiologic Bases;" Dr. W. Edward Chamberlain, 1941, "Fluoroscopes and Fluoroscopy;" Dr. Eugene P. Pendergrass, 1942, "Excretory Urography as a Test of Urinary Function."

For the Joint Meeting of the Radiological Society of North America and the American Roentgen Ray Society in 1944, the Carman Lecture, as was fitting, was combined with the Caldwell Lecture of the latter organization, this double honor falling upon Dr. Lawrence Reynolds, who addressed the assembled societies on "The History of the Use of the Roentgen Ray in Warfare."

In 1945 Dr. Robert R. Newell was named Carman Lecturer. As members of the Society will recall, the scientific sessions were cancelled on account of travel restrictions, and it was at first feared that Dr. Newell's lecture would be delivered "by title" only. Happily this was not the case, for the appointment was held over to 1946, and at the largest meeting in the Society's history, Dr. Newell gave the eleventh Carman Lecture, reproduced in full in the ensuing pages.



R. R. NEWELL, M.D.
Carman Lecturer, 1946

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Quality of Radiation in Roentgen Therapy¹

Carman Lecture

R. R. NEWELL, M.D.

San Francisco, Calif.

I FIRST MET Russell Carman when he was President of the Radiological Society of North America and I was just learning my way about in radiology. I shared your admiration for him, those of you who knew him, and shared your depression and sense of loss when he died, only a few years later. There have been ten Carman Lectures, delivered by a selection of the best minds of our Society, who have often expended their best efforts in honoring his memory. Need I say that I feel keenly the honor of joining this illustrious company?

Although Russell Carman's career was in diagnostic radiology, yet I have chosen a therapeutic subject for this lecture.

The invention of 200-kv. x-ray machines created such a revolution in therapy that we all became very quality conscious. Dr. Chamberlain and I were deeply concerned to choose between 0.5- and 0.75-mm. copper filtration—this in spite of our experience in measuring all the deep-therapy outfits in California (1) and finding their 10-cm. depth doses all alike (regardless of large differences in output). Later we tried two different qualities on small skin areas, and found that the erythemas from equal doses looked alike (2).

The conviction that the importance of differences in quality is apt to be overestimated and over-emphasized has grown rather than lessened with added clinical experience. I have tried faithfully to choose the quality according to the case, but remain unconvinced of my clinical ability to distinguish the effects of small differences, easily measurable by physical means. I have had opportunity to talk about the biologic and clinical implications of quality before (3). This time I wish to

start with the more practical engineering and physical aspects.

We owe a great debt to the engineers who have built machines to give a range of quality from grenz rays at 10,000 volts through one and two megavolts and on, with the betatron, to 30 megavolts and beyond. Surely, if we can only know what we need, we can have it, just so we can pay for it! I am overcome by admiration for the inventiveness and skill of the men who have driven x-ray production to such heights. And presumably the end is not yet!

We owe a great debt, also, to the physicists who have taught us to measure x-ray precisely and have devised a unit of most peculiar "dimensions" exactly suited to our clinical needs. It may require a 20 per cent increment in dose to be observable clinically, but we can do the physical measurement with an accuracy of 2 per cent. Most of us, in fact, do this as an everyday matter.

The physicists have given us standards of quality, too. We have the international agreement to designate quality by half-value layer (h.v.l.), naming a suitable absorber. Now this is a very delicate method, capable of detecting a change of a few kilovolts on the tube or a few per cent increase in filtration. I am not sure that this was so great a service. It resulted in a senseless striving for slightly harder qualities and a competition among apparatus makers that did our profession no good. Do you remember the violent controversy: constant potential *vs.* pulsating rectified? It seemed axiomatic to us then that, since one so easily measured the difference (h.v.l.'s 1.2 and 0.9 mm. of Cu), it must

¹ Delivered at the Thirty-Second Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 3, 1946.

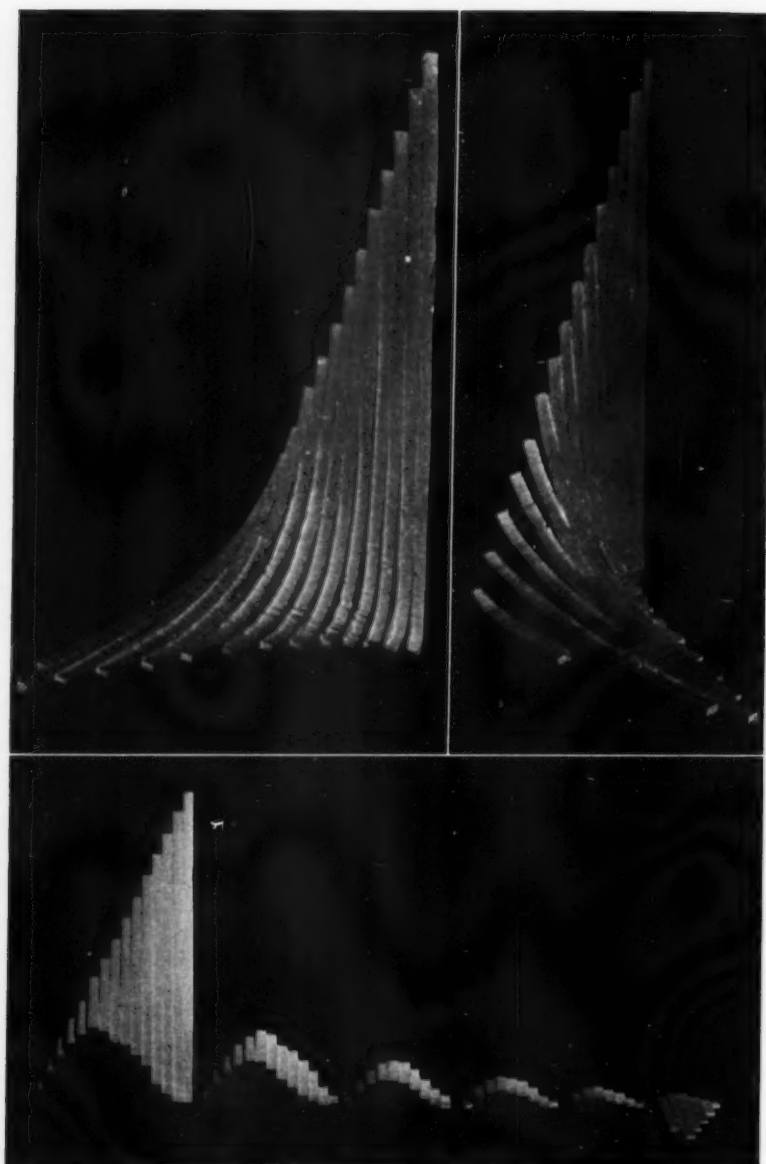


Fig. 1. Model to show the effect of filtration on a heterogeneous beam of x-ray (photo-electric absorption, neglecting scattering). One is looking at the model from the back. The face is a plane triangle corresponding to the graph on the frequency scale of Fig. 2. In the lower photograph, saw cuts separate the portions absorbed by successive layers of filter. Note how the huge mass of low frequency (long wave length) radiation is removed by the first filter. After this, further filtration reduces the quantity and shifts the maximum only slowly to the left (harder qualities).

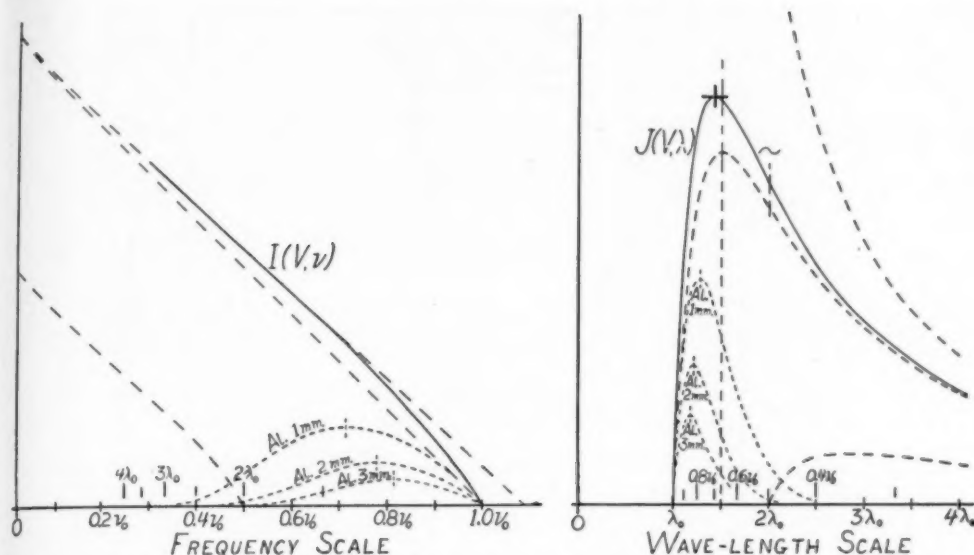


Fig. 2. Spectrum of the heterogeneous beam of x-ray coming from a thick target. (From Webster and Hennings.)

therefore be important. I am not sure but that one of the most useful by-products of "supervoltage" may be the laying of this ghost. When one finds so little clinical difference between h.v.l.'s 1 mm. and 5 mm. of Cu, one really can no longer break one's heart over a fraction of a millimeter. But the ghost has life in him still! The competition is picking up, and we are "sold" on the superiority of 250 kv. over 200.

Quality is obtained by voltage and filtration. High voltage costs much money; heavy filtration costs much x-ray. This is to say: to make x-ray hard by filtration, you have to throw a large amount of the beam away. Of course, you can't put in what wasn't there to start with; you can only remove the softest components. Figure 1 shows a three-dimensional model illustrating the effect of filtration on a beam of heterogeneous x-rays. This is based on an observation by Webster (4) that, plotting quantity against frequency, one gets nearly a straight line (Fig. 2). The quantity in a low-frequency sample is large, and diminishes with increasing frequency until it is zero at the high-frequency limit (minimum wave length).

Now each of these samples is absorbed as

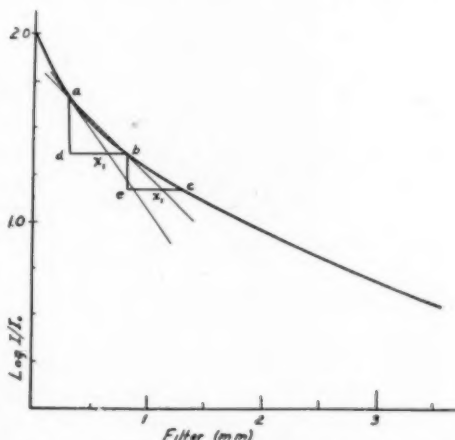


Fig. 3. "True" effective wave length vs. Duane's "effective wave length." On the complete absorption curve, *a* marks the exit from the working filter, *b* marks the transmission through added 0.25 mm. Cu. The slope of the secant *ab* gives the effective wave length according to Duane. The tangent at *a* gives the "true" effective wave length, without the error produced by hardening within the test filter. (From Taylor.)

it goes through the filter, the low frequencies more than the high frequencies. The (photoelectric) absorption of each frequency sample (monochromatic) is logarithmic. The half-value layer increases with the cube of the frequency. The front view of the model (Fig. 1) shows the frequency

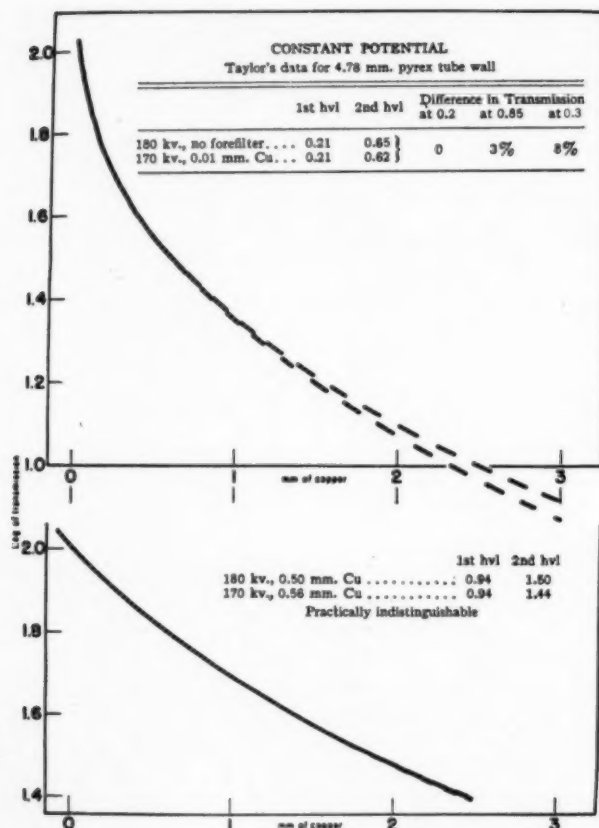


Fig. 4. Two x-ray beams having the same h.v.l. may yet be different, as shown by carrying the absorption curve out farther (upper curves). This discrepancy appears less for heavier fore-filters (lower curves).

samples. The side view shows the absorption curves, different of course for each sample. The four lowest frequencies are so absorbable, drop to almost nothing so quickly, that they have been left off.

Cutting the model across at various thicknesses of filter shows how great a hardening comes from the first layer and how slowly the hardening proceeds after that and how small a quantity remains after really heavy filtration. One has so little of the very high frequencies to start out with. Considering the hardest portion, one would do well to increase the voltage 10 per cent and so double the original quantity of the top 10 per cent sample (now the next to the top).

SPECIFICATION OF QUALITY

In the earliest days of x-ray, quality was designated by the "parallel spark gap" (between points). When we began to filter our x-ray beams, of course we had to say what filter. The engineers then told us we ought to use sphere gap. Fortunately this was always calibrated in kilovolts, so one always knew that a published spark-gap (inches or centimeters) meant points. I don't see that point gap is such a poor measure, but the matter is academic now, for modern machines are all enclosed, with no place to connect a spark gap. One has to accept the factory calibration.

Then there was a great furor about spectrographic determination of the short wave

TABLE I: DIFFERENCES IN LOG TRANSMISSION THROUGH SUCCESSIVE HALF MILLIMETER COPPER FILTERS (Smoothed Values from Data of Taylor and Singer for Constant Potential)

Filter 5 mm. Pyrex plus mm. Copper	Kilovolts Constant Potential								
	100	110	120	130	140	150	160	170	180
0 to 0.5	0.786	0.722	0.667	0.620	0.580	0.547	0.520	0.499	0.484
0.5 to 1.0	0.312	0.278	0.252	0.231	0.216	0.205	0.194	0.182	0.175
1.0 to 1.5	0.257	0.225	0.203	0.184	0.171	0.160	0.150	0.143	0.138
1.5 to 2.0	0.224	0.194	0.174	0.157	0.145	0.135	0.126	0.120	0.116

EXAMPLE OF CURVE-FITTING BY COMPARISON OF DIFFERENCES IN LOG TRANSMISSION (200 Kv., Mechanically Rectified, 5-mm. Pyrex Tube)

Filter, mm. Cu	r/min.	log r/min.	Differences	Taylor's 160 kv. from Table Above
0	283	2.452		
0.5	97	1.987	0.465	0.520
1.0	62	1.792	0.195	0.194
1.5	46	1.660	0.132	0.150
2.0	34	1.533	0.127	0.126

limit (5). Because the end of the spectrum contains little x-ray (especially on pulsating potential) the spectroscopist always measured the voltage 5 or 10 per cent below what the spark gap indicated. This was supposed to be very bad—that one claimed he was using 200 kv. and the spectrum only went to 180 kv. This was hardly short of cheating! But nobody dared to insist that we ought to determine our quality by photometry of the spectrum. It is true that the spectrum does give the ultimate analysis of composition of an x-ray beam, but so many corrections have to be applied that it's completely impractical. We did all agree that absorption measurements are the way to determine quality.

It was pretty obvious that to designate quality by a complete absorption curve was much too cumbersome, although Ernst did on one occasion make just that suggestion (6). What was needed was a simple numerical designation of quality. Long before the International Committee plumped for h.v.l., Duane (7) had advanced the "effective wave length." This he designated as the wave length of monochromatic x-ray which would show the same absorption in copper as the x-ray beam in question. Since clinical x-ray beams are



Fig. 5. Spectrogram of x-ray beam at 85 kv., filtered through 0.65 mm. Cu (right half) vs. 0.22 mm. Sn (left half), showing the large amount of x-ray coming through the tin at wave lengths just longer than the K absorption edge. This was made with diamond, because this crystal gives no reflection (diffraction) in the second order. Otherwise, the second order of the tungsten characteristic would have overlapped the tin discontinuity.

not monochromatic, the match could only be over a certain range, and Duane chose 0.25 mm. Cu. This was really an excellent convention, and deserved to be perpetuated. It gave in a single number a quite adequate measure of quality for clinical purposes.

But some people are never satisfied. I recollect with shame how I complained that 170 kv. constant potential and 200 kv. pulsating rectified, filtered to give the same effective wave length, could not in fact be

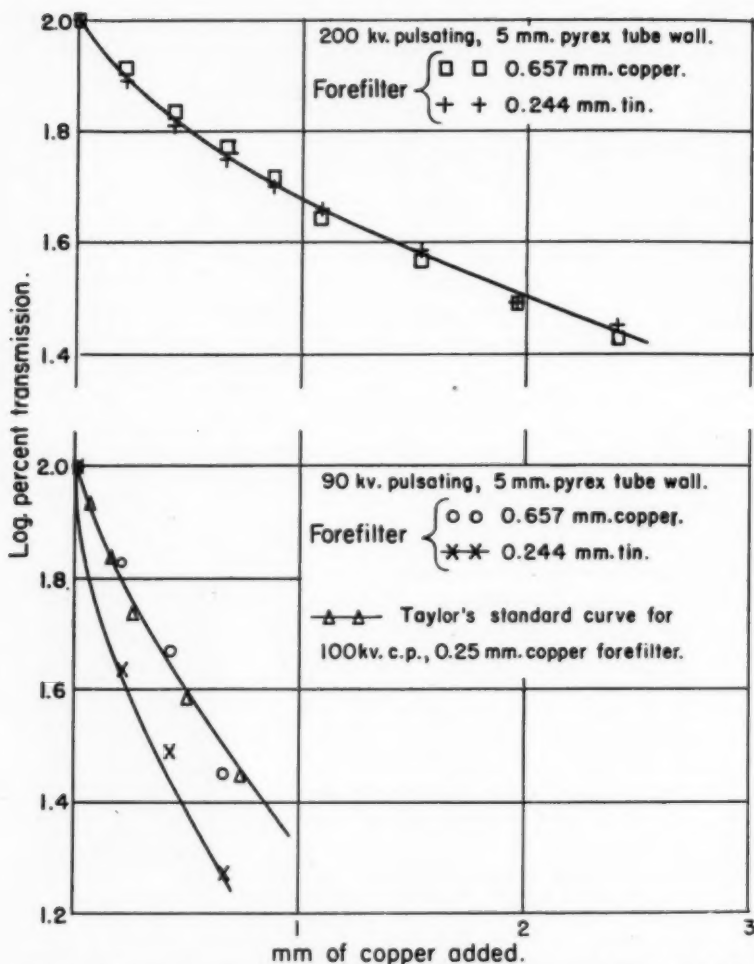


Fig. 6. Absorption curves for tin-filtered and copper-filtered x-ray beams are similar at high voltages (upper curve) but cannot be brought to match at lower voltages (lower curves). Note that the first 0.2-mm. Cu added filter "closes the window" in the tin forefilter. This "window" of anomalous transmission had evidently been augmenting the beam by about 60 per cent.

the same in composition. True, but so unimportant! And then the purists pointed out that the beam was really softer than indicated by Duane's "effective wave length" because he had hardened it in measuring it (by the 0.25-mm. Cu filter). What one should do was to draw the whole absorption curve and take the tangent through the initial point (8), not (as Duane did) the secant through this point and the 0.25 mm. Cu point (Fig. 3). This controversy was starved out, of course,

after the international acceptance of h.v.l. for the designation of quality.

Then Lauriston Taylor took over the x-ray standardization work at the National Bureau of Standards and ran the most precise absorption curves on clinical qualities of x-ray that we have (9). Some of his observations should have made things simpler for us, *e.g.*, that the absorption curves are all of pretty much the same general shape and that constant potential is nearly like pulsating potential of the same

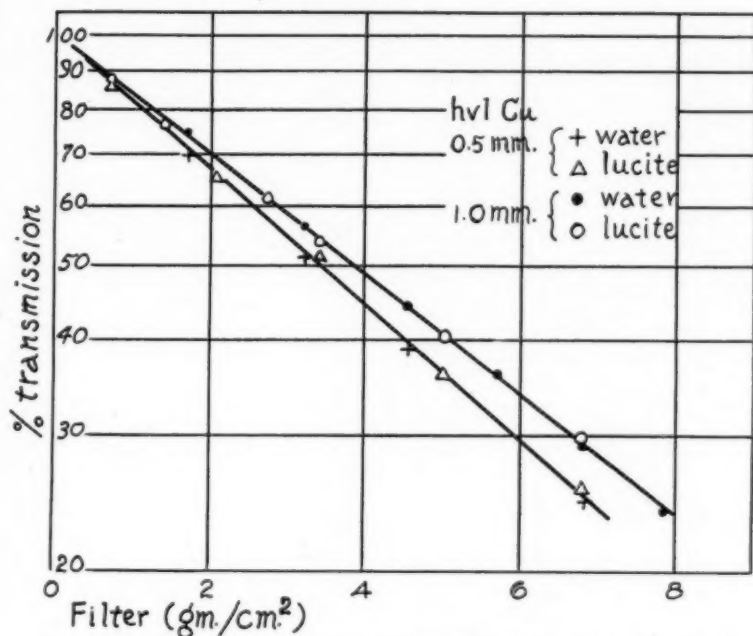


Fig. 7. Absorption curves in water and in lucite for 200-kv. x-ray beams filtered to give copper h.v.l.'s 1.0 and 0.5 mm. Note that the filters are measured in gm./cm.², so as to avoid the discrepancy in their densities.

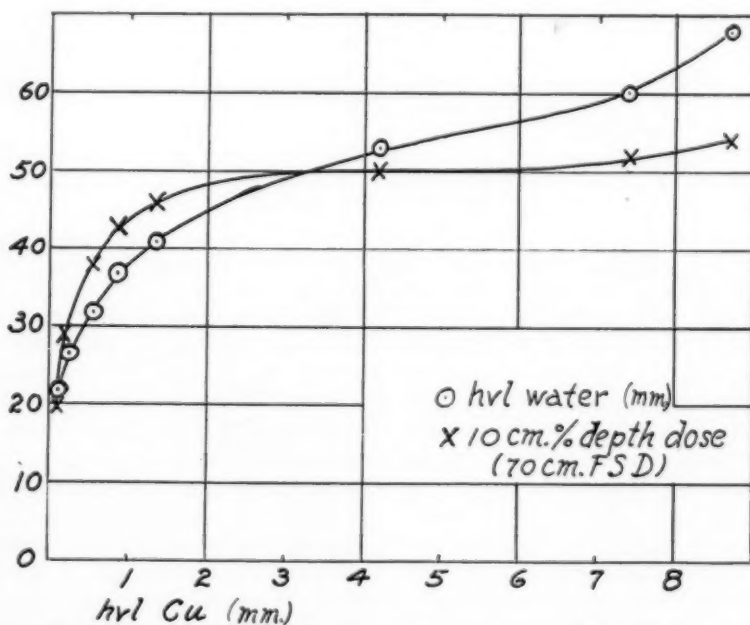


Fig. 8. Relation of the h.v.l. in water and the 10 cm. percentage depth dose to the quality of x-ray as measured by h.v.l. in copper. (Exner's data.)

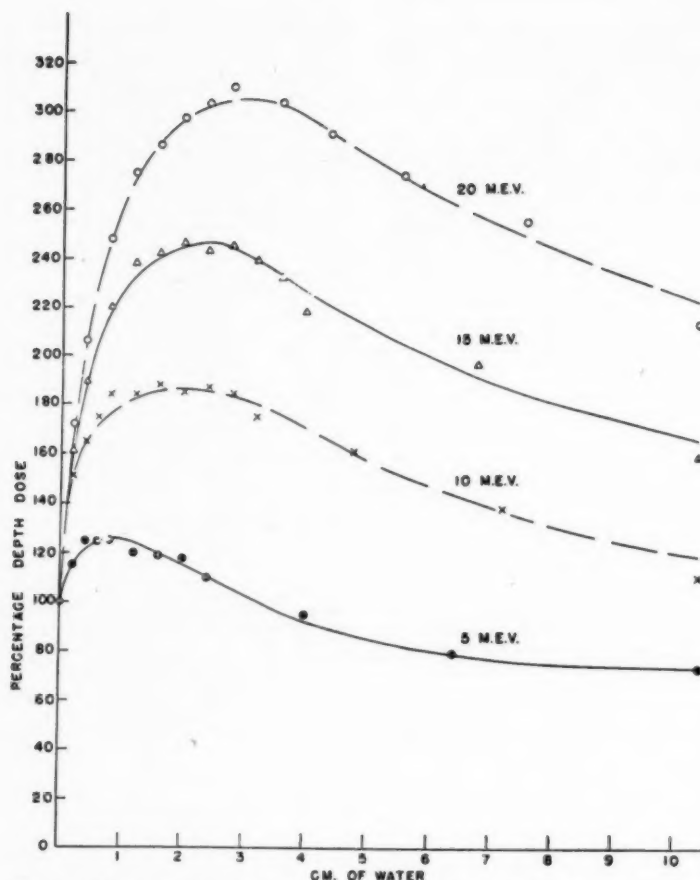


Fig. 9. The percentage depth doses and exit doses from betatron beams are enormous. (From Koch, Kerst and Morrison.)

r.m.s. value (10). Being a perfectionist, he wanted us to match our clinical curves to one of his c.p. ones and call our quality by naming his voltage and filter. I was quite taken in by this, being too much inclined to bootless perfectionism myself. I observed that one could make the match by figures, comparing logarithmic differences, and so get it down to the third significant figure.

We are impressed by the shortcomings of the internationally accepted h.v.l., for two beams could have the same first half-value layer and yet be so different in heterogeneity that the lower parts of their curves would deviate. So some of us talked about naming first and second h.v.l.'s. Exner

(11) called the ratio of 2nd h.v.l. to 1st h.v.l. the homogeneity coefficient (Fig. 4).

Later I was able to produce two beams, one filtered through copper and the other through tin, so different in composition, on account of the absorption discontinuity in tin at 0.4 \AA (Fig. 5), that none of Taylor's standard curves would match it (Fig. 6). So Taylor's "perfect" method was not completely general after all.

If we had not still been suffering from the superstition that small differences in physical quality were of importance to the patient, we would have seen that naming the r.m.s. voltage and the filter is quite precise enough.

A number of workers had called atten-

tion to the "window" in any filter due to the absorption discontinuity (illustrated in Fig. 5), pointing out that a lead filter must be backed by tin and a tin filter by copper (12). It seemed that perhaps the Standards Committee ought to designate certain standard qualities which could then be referred to by letter or number (Table II).

TABLE II

Symbol	kv.	Filter
A	12	0
B	50	0
C	50	1 mm. Al
D	50	0.3 mm. Cu
E	100	0
F	100	1 mm. Al
G	140	0.25 mm. Cu + 1 Al
H	200	0.5 mm. Cu + 1 Al
I	200	0.4 mm. Sn + 0.5 Cu + 1 Al
J	400	1 mm. Sn + 0.5 Cu + 1 Al
K	1,000	1 mm. Pb + 0.5 Sn + 0.5 Cu + 1 Al

I suspected that this would never be accepted; doctors would never yield to such dictation. But I was still playing with the idea of quality designations by a single name. I was distressed by published case reports, reading, for example, "pulsating potential, 196 kvp., 5-mm. pyrex tube wall, plus 0.5 mm. Cu, plus 1 mm. Al, h.v.l. 0.99 mm. Cu."

Now hard qualities are absorbed in light elements mostly by the scattering mechanism, which changes little with wave length. So it was already well accepted that the harder the quality, the higher the atomic number needed in the filter for measuring its h.v.l. By adding one filter material to the list customarily accepted, it would be possible to cover the whole clinical range, with a unique name for each quality (Table III). I think it was U. V. Portmann who made me see how impossible it would be to get doctors to agree to such a strait-jacket as this.

However, it would indeed be advantageous if we could designate quality by a single number. To do this, we have to agree on a single test filter substance. It should be so light that its K absorption edge will be quite out of the way; otherwise the values will not run upward smoothly.



Fig. 10. Epilation produced by 600 r, h.v.l. 0.3 mm. Al. With this quality the usual 300 r is entirely inadequate.

TABLE III

h.v.l.	Designation
5 mm. celluloid.....	Plastic
1 mm. Al.....	Aluminic
1 mm. Fe.....	Ferrie
1 mm. Cu.....	Cupric
1 mm. Sn.....	Stannic
1 mm. Pb.....	Plumbic

Water comes first to mind, particularly because it is absorption in water that dominates the clinical use of radiation. More than one friend has asked, pointedly enough, why our physicist gives him h.v.l. in copper, when it's not copper he's irradiating, Figure 7 shows logarithmic absorption curves in water for two common qualities of x-ray. They seem to show no curvature. Mayneord (13) has measured some hardening in the supervoltage region just by water, but it hardly shows on absorption curves. Of course, filtration can't harden the ray very much, when

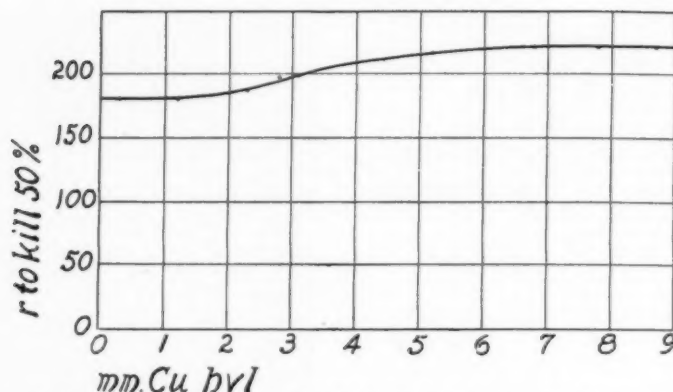


Fig. 11. Quality dependence of biologic effect of x-rays. The 50 per cent lethal dose for *Drosophila* eggs changes by about 20 per cent over a quality change 1 mm. to 6 mm. h.v.l. Cu. (Packard's data.)

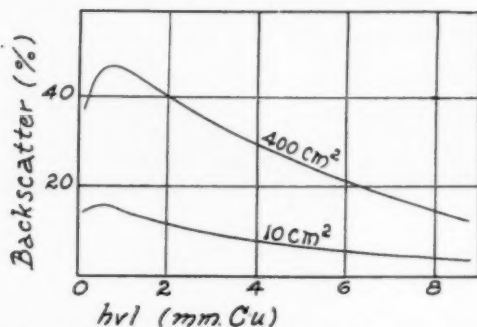


Fig. 12. Dependence of back-scattering on quality and area. (From Exner and Packard.)

there's so little difference in the absorption of the soft and hard portions of the beam. Note the small difference in slope of the two qualities illustrated in Figure 7. Their h.v.l.'s in water differ by only 10 per cent, but that's similar to the percentage difference in their penetration as used clinically.

Figure 8 is adapted from Exner's data (11). It plots h.v.l. in water along with 10 cm. percentage depth dose over a long range of qualities. Note that for softer qualities depth dose changes faster than h.v.l. in water, and for hardest qualities *vice versa*. But, taken all in all, the two run pretty much together.

Let us take two qualities, h.v.l. in water 40 mm. and 50 mm., respectively. Seeing the ratio, $50/40 = 1.2$, one might jump to the conclusion that the second is 20 per cent

better than the first for reaching deep-seated cancer. This would surely be nearer to the truth than if one had compared their h.v.l.'s in copper, namely 1.25 and 4.5, and concluded that the latter should be about three and a half times as good as the former.

Now measurements in water are, in fact, inconvenient. It would be easier if we had a similar absorber in solid sheets. Lucite seems convenient for this, but is slightly denser than water ($d = 1.13$) and to make it match must be measured not in centimeters, but in gm. per sq. cm. (Fig. 7).

I have had no opportunity to try this scheme at 2 megavolts, nor at 30 megavolts. Those who use the betatron for therapy have a difficult problem of measurement before them, for depth dose is built up by the accumulation of recoil electrons along the beam (14). One could measure the extinction coefficient in water (or lucite) by removing the recoil electrons with a magnet before they get to the ionization chamber, but I doubt whether the data would be clinically worth having. Anyone reporting on treatments with a betatron will have to measure and report the very large depth doses in a phantom, and the large exit doses (Fig. 9). Small differences in quality are unimportant here, too, and the estimated megavolts will be precise enough.

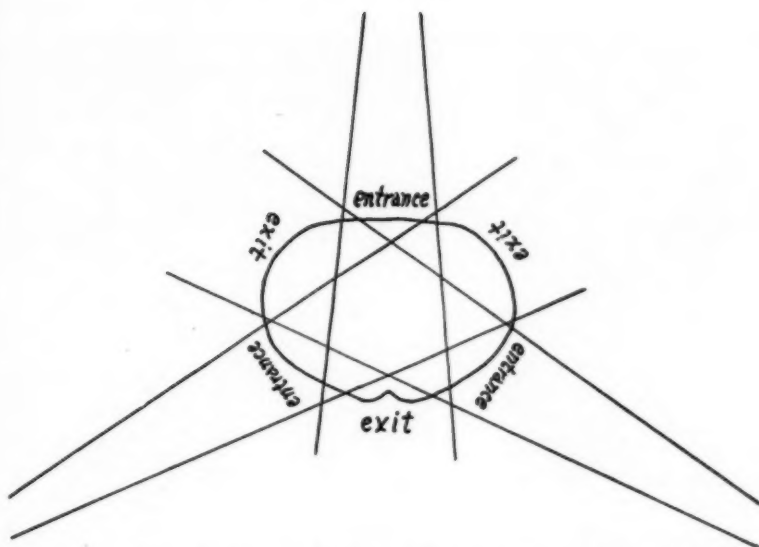


Fig. 13. Irradiation of pelvis through three equidistant ports, to avoid superimposition of exit doses.

COMPARATIVE INFLUENCE OF EXIT SKIN DOSE USING HIGH AND SUPER VOLTAGE

CASE OF THICK SECTION 24 CM.

10X10 FIELDS

20X20 FIELDS

SINGLE-FIRE

CROSS-FIRE

SINGLE-FIRE

CROSS-FIRE

200 K.V.

100	27.5	3.2	103.2	55	103.2	100	37	8.5	100.5	74	100.5
100			100	83.3	100	100			100	70.2	100

1000 K.V.

100	41	11	111	82	111	100	48	15	115	96	115
100			100	73.9	100	100			100	83.6	100

RATIO $\frac{1000 \text{ KV}}{200 \text{ KV}}$

$\frac{41}{27.5} = 1.49$

$\frac{73.9}{83.3} = 1.39$

$\frac{48}{37} = 1.30$

$\frac{96}{70.2} = 1.39$

Fig. 14. In direct cross-fire technic, going to harder qualities, the augmented exit dose may easily undo all the advantage one had hoped to gain by the diminished back-scattering. Although the cross-fire depth dose with large fields is 74 per 100 applied for 200 kv., and 96 per 100 applied for 1,000 kv., yet the exit dose has amounted to so much more for the latter that the comparative ratios of depth to total skin dose are 83 for 1,000 kv. against 70 for 200 kv., only a modest improvement. (From Stone and Aebersold.)

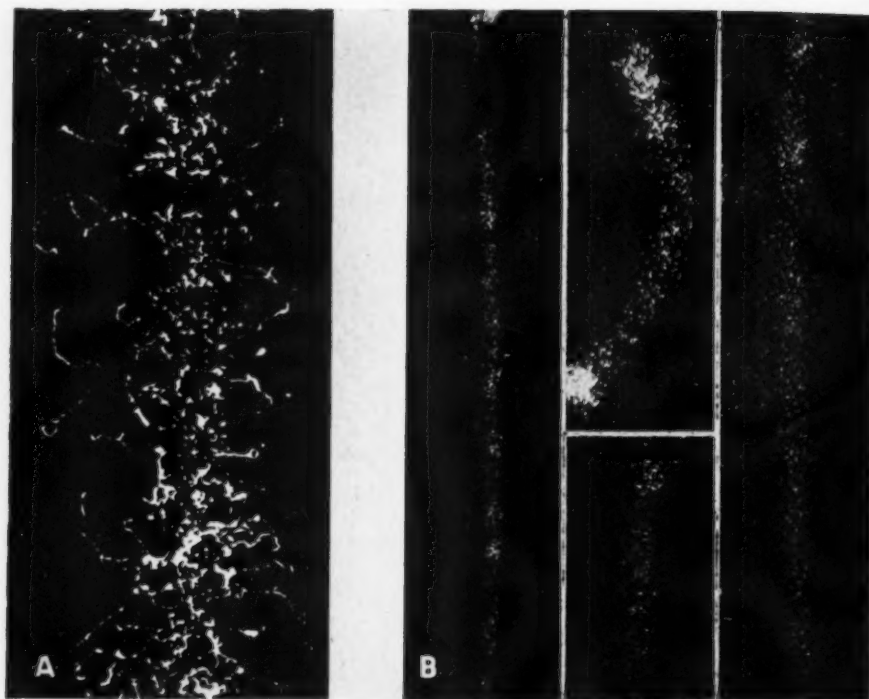


Fig. 15. A. In the Wilson cloud chamber, water droplets condense on the ions produced by photo-electrons from a narrow beam of x-rays (low voltage). (From Wilson.) B. Ionization along paths of very high-speed electrons, broadened by diffusion. Note uneven distribution (clusters). (From Corson and Brode: Phys. Rev. 53: 773-777, 1938.)

In the megavolt region, nuclear absorption becomes important, increasing with frequency, also with atomic number. This may, at high enough voltages, result in a paradox, namely that filtration may soften the beam (in the sense of absorbing out the short wave lengths more than the long ones).

I would like now to reiterate my conviction, expressed in past years, that more attention has been paid to quality than it deserves. In some ranges quality is important. Using h.v.l. 1 or 2 mm. Al, epilation of the scalp is ordinarily done with 300 r to each of five areas. Using a "contact therapy" machine with h.v.l. 0.3 mm. Al, 600 r is barely sufficient (Fig. 10). Packard (15) was long skeptical of any difference in biologic action between one quality and another. But he was able to show a quality dependence for *Drosophila* eggs (16) when the dose is measured by the Vic-

toreen "air wall" chamber (Fig. 11). Stone (17) showed that 23 per cent more x-ray (measured as tissue dose in the skin) was needed at 1,000 kv. than at 200 kv., but that when this quantitative adjustment had been made, then the reactions came up alike, looked alike, and recovered alike. I have not reproduced his photographs, for they are in color. The reader ought to review his essay, for it reports one of the neatest clinical experiments ever done in this field.

Reference should be made to Lauritsen's (18) calculations showing that the specific energy absorption per roentgen in the surface layer should be different for different wave lengths. Many workers have reported the dependence of "erythema dose" on quality. They are not all in quantitative agreement, and many are at variance with my clinical impressions.

Precisely measured and well tabulated,

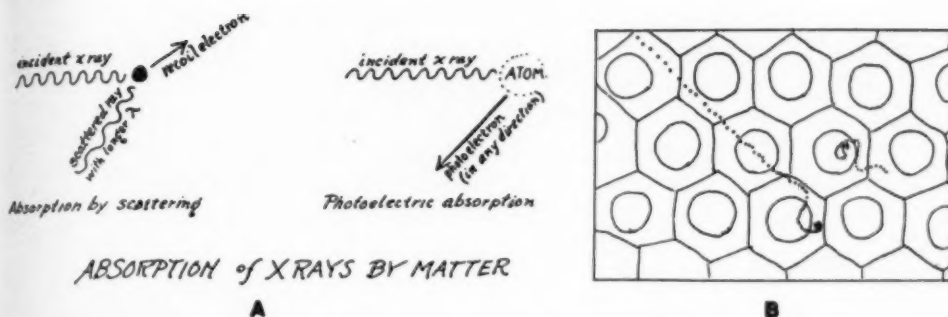


Fig. 16 A. Idealization of the two mechanisms of absorption of x-ray energy, namely photo-electric and Compton scattering. The product is a high-speed electron. B. The high-speed electron leaves a track of ionization as it passes through the cells.

however, are the gross differences in penetration and back-scattering (Figs. 8 and 12). Those of us who measure our doses "in air" use such tables, e.g., Quimby's (19), every day to calculate the "skin dose" and the "tumor dose." The careful worker will choose a technic and a quality adapted

accurately. A precision of 15 or 20 per cent is about the limit. Moreover, the sensitivity of the same tissue (skin) varies markedly from one location to another in the same patient. And one continually runs across individuals of unusual radio-resistance or unusual radiosensitivity.

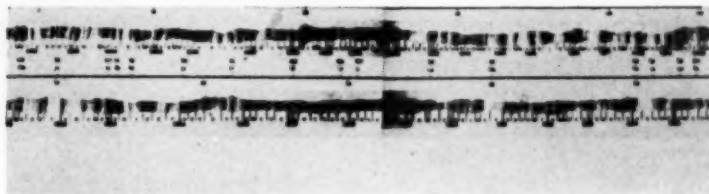


Fig. 17. Giant chromosomes from the salivary gland of an insect (*Drosophila*). Presumably the cross-banding marks the locations of the genes, which in the normal-size chromosomes of the ordinary somatic and sex cells exist as single biomolecules. Irradiation can destroy a single one of these genes, leaving the rest intact (point effect). (From J. Heredity 26: 62, 1935.)

to that technic which will get a desired quantity of radiation into the part of the patient where it is wanted. Multiple fields with exit doses avoiding the input areas are an example, using the harder qualities (Fig. 13). In this, one escapes the difficulty pointed out by Stone (20), that cross-fire technic on the pelvis gives little better central dose with 1,000 kv. than with 200 kv., except in large patients (Fig. 14).

I realize that my arguments have been physical and theoretical. I don't wish you to think that I'm ignoring clinical experience. That in the end must be the critical test. But clinical results are hard to read

In treating cancer we are forever driving the dose up to the limit from which the normal tissue can recover. If complete destruction of skin epithelium can be attained by a course totaling 5,000 r at h.v.l. 1 mm. Cu, it is my experience that this dose doesn't have to be altered more than about 20 per cent when using other qualities between h.v.l. 0.3 mm. Al and 6 mm. Cu.

THE FUNDAMENTAL PHYSICAL ASPECT OF QUALITY

The physical process of absorption of x-ray produces high-speed electrons and these produce ions. I can see nothing

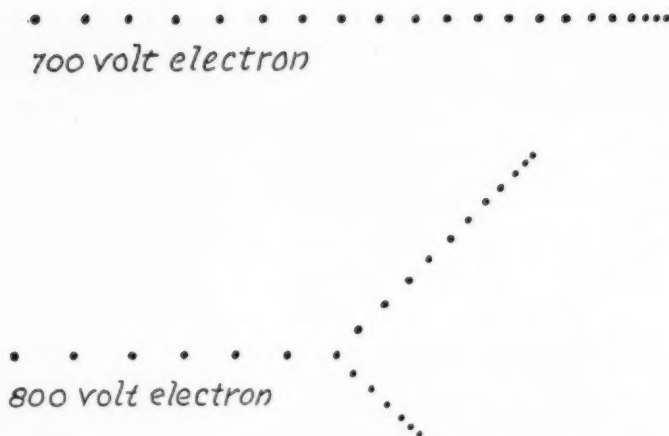


Fig. 18. Diagram of the increasing columnar density (specific ionization) as the high-speed electron slows down toward the end of its path. Branched tracks are not infrequent, so that clusters of ions account for half to two-thirds of the total. For simplicity, the crooked track has been drawn straight and the inequalities of probability smoothed out.

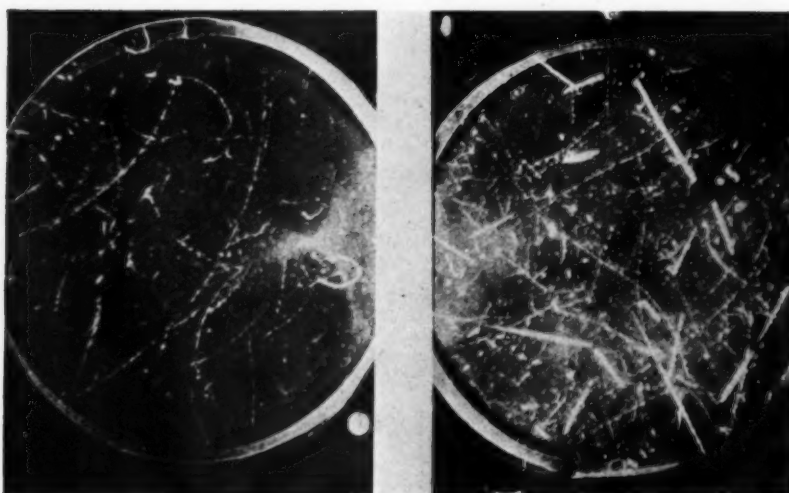


Fig. 19. Contrast between the relatively sparse ionization along the tracks of high-speed electrons (from gamma rays) and the very dense ionization along the tracks of recoil protons (from fast neutron rays). Cloud chamber photographs by courtesy of Dr. E. O. Lawrence. Left-hand photograph: gamma rays produce recoil electrons whose paths are curved in the magnetic field. Right-hand photograph: neutron rays produce recoil protons whose paths are nearly straight and very densely ionized.

available in this for any biologic specificity. The cloud tracks of Wilson and of Brode, in Figure 15, show what I'm talking about. The sketches show how I imagine the tracks of ionization go in tissues (Fig. 16). You are acquainted with the genetic evidence proving that x-rays can affect one

tiny part of the cell (one gene) (Fig. 17). The collisions that produce the ions make the electron tracks crooked (Fig. 15). In order to see better what is going on, let us pretend that they are straight. Figure 18 shows how the ions get thicker and thicker toward the end of the path. In this region

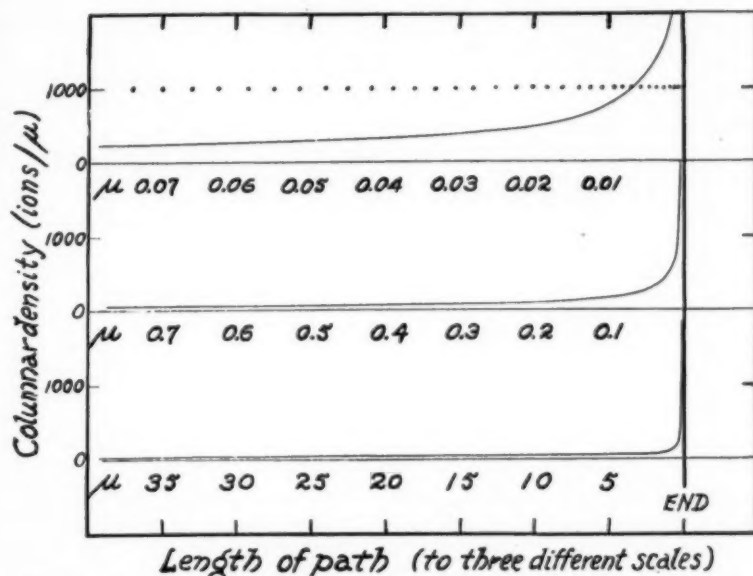


Fig. 20. Specific ionization (columnar density of ionization) along an electron track. At the top is shown how the ions get thicker as the electron slows down. Superimposed is a plot of this picture. In order to show a greater length of the track, the scale has been compressed by a factor of 10 for the third line. This still shows only the terminal 0.7 micron of the track, so in the last line, the scale has been compressed by another factor of 50. Branching (clusters) has been ignored.

the probability of ionization increases as the inverse square of the speed of the electron (inversely as the energy). Not all tracks are single; a collision may give so much energy to the electron struck that it will go off on an ionizing path of its own. Clusters due to such branching may account for two-thirds of the total ions (21).

Now it is known that biologic effect is correlated with this columnar density of ionization. Neutron rays give recoil protons (Fig. 19), and the ionization along these paths is more like that of alpha rays—a hundred times as dense as along an electron's path. And we know that ion for ion, neutron rays have two to ten times the effect of x-rays on living tissues (22).

So maybe here is the physical basis for a biologic dependence on quality. Mayneord (23) has calculated that over the whole range of clinical irradiation, 10 kv. to 2,000 kv., the average length of path (ionization track) might vary by a factor as large as six. Now this is small, when in comparing

x-rays and neutron rays we realize that a factor of one hundred is needed in columnar density of ionization to give a biologic factor of about five.

Nevertheless, let us look at the columnar densities produced by various x-ray qualities. These are plotted in Figures 20 and 21, but remember they are not simple like this, but always very much mixed, for scattering occurs at all angles and so in every quality the scattering produces a great variety of energies in the resulting recoil electrons. Moreover, these plots ignore the frequent clusters due to branching.

The thing in this picture that impresses me most is that every electron, high-speed or low-speed, ends up the same way, in a densely ionized spot. Maybe we ought to give these credit for most of the biologic effect. Maybe what is important is the number of photo- and recoil electrons produced (per cubic micron). Maybe the ions of lesser columnar density along the high-speed portions of the tracks are very inefficient. Maybe, when we go to a mil-

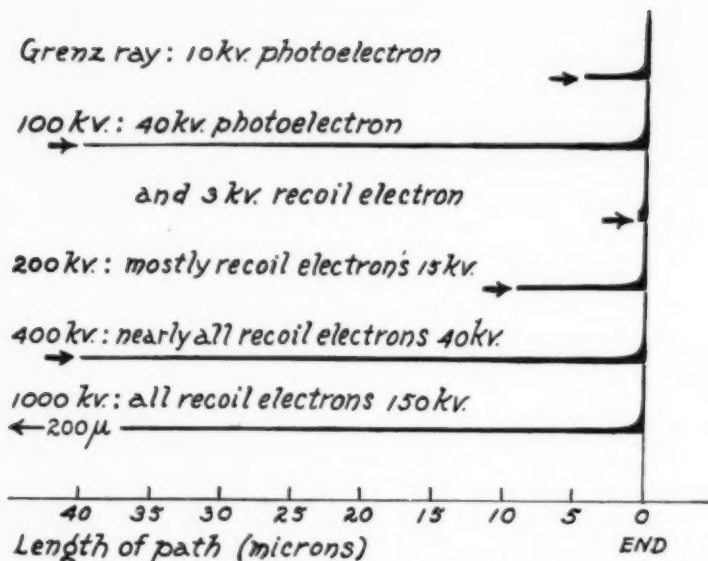


Fig. 21. Rough designation of specific ionization by plotting the track of a typical high-speed electron produced at each of the several clinical qualities of x-ray. The important thing to see is that all qualities give electrons and that all of these, high-speed or low-speed, end up the same way, in a spot of dense ionization. It is presumably this spot that holds most of the biologic effectiveness.

lion volts, we merely add on a lot of long, sparsely ionized high-speed preliminaries that practically waste their ions. Maybe this accounts for the need to add 25 per cent to the dose (total volume ionization) to make the effect of 1,000 kv. match that of 200 kv. You will note that this latter quality just about attains a minimum average length of ionization track and so a maximum number of individual tracks for a given total number of ions (dose).

But I still don't see very clearly how one quality is going to be better able than another to ferret out the cancer cell.

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A Duodenal Mechanism Regulating the Motor and Secretory Activity of the Stomach

Its Roentgenographic Disturbance in Duodenal Ulcer¹

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A major roentgenologic problem arises from the difficulties encountered in interpreting abnormal motor and secretory disturbances in a large percentage of persons suspected of having a duodenal ulcer (2, 11). These abnormal motor changes are disturbances of gastric tone, peristalsis,

person with a normal gastro-intestinal tract, a 250-c.c. water-barium meal usually is emptied from the stomach in sixty minutes. If this procedure is repeated with a 250-c.c. 0.25 per cent hydrochloric acid-barium meal, gastric emptying is delayed. If a similar concentration of hy-

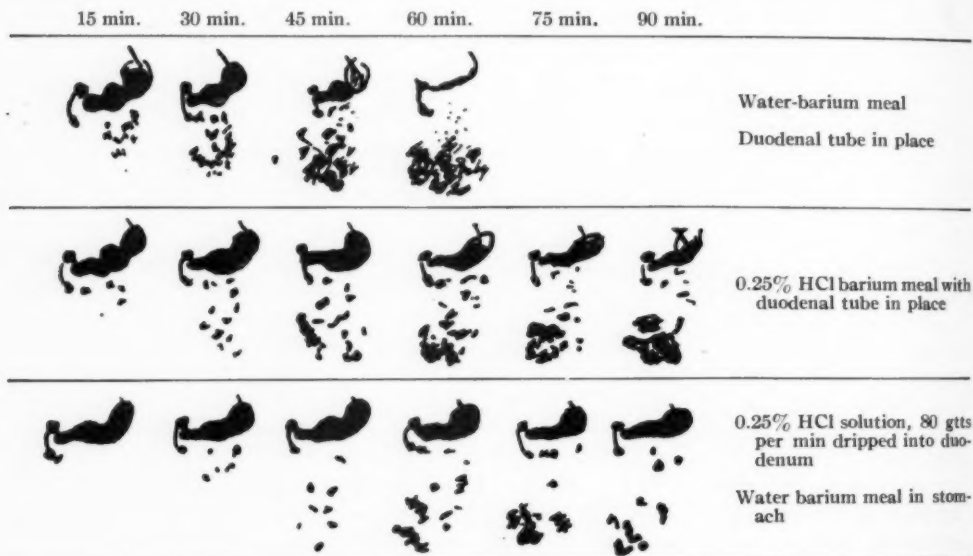


Fig. 1. Gastric emptying is more retarded by acid on the duodenal than on the gastric side of the pylorus.

and action of the pylorus, which is an important regulator of gastric emptying. The mechanism regulating all these activities seems to be housed in the duodenum, to be referred to here as the "duodenal mechanism" (8, 9).

THE DUODENAL MECHANISM

In looking for the factors which control gastric emptying, it was found that in a

drochloric acid is dripped directly into the duodenum, a more marked delay occurs. Acid on the duodenal side of the pylorus thus seems to have a greater effect on the retardation of gastric emptying than does acid on the gastric side (Fig. 1).

While this applies to all subjects, there are quantitative differences due to variations of gastric acid secretion among different individuals and, sometimes, in

¹ Read by title at the Thirty-first Annual Meeting of the Radiological Society of North America, Chicago, Ill., Nov. 9-10, 1945.

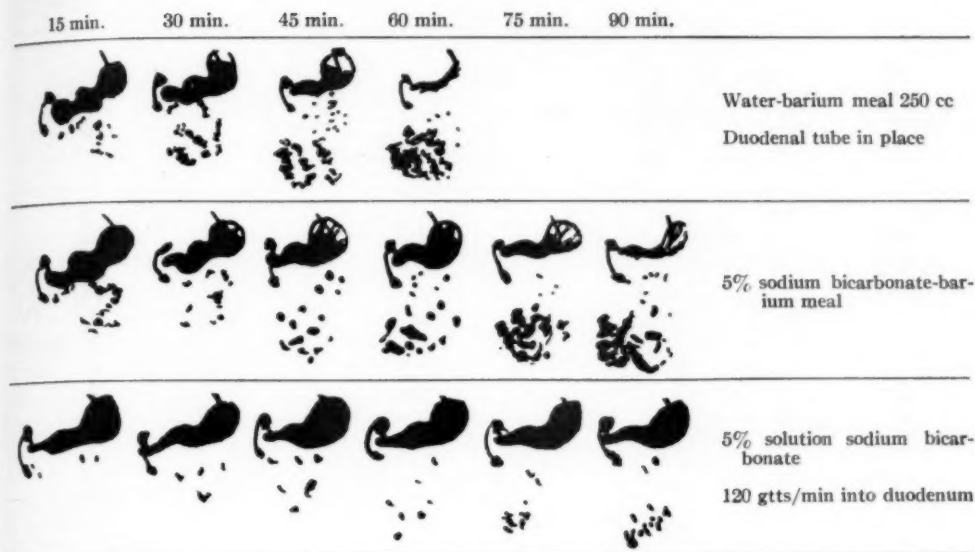


Fig. 2. Gastric emptying is more retarded by hypertonic alkaline solutions on the duodenal than on the gastric side of the pylorus.

the same individual. Thus, if a weaker acid concentration, such as 0.1 per cent hydrochloric acid solution, is dripped into the duodenum, the slowing of gastric evacuation is greater in an achlorhydric individual than in one with normal gastric secretion.

With stronger acid solutions, such as 0.5 per cent hydrochloric acid, not only is stimulation of the duodenal mechanism more intense, but also there is a greater uniformity of response regardless of the intrinsic variation in gastric secretions among different subjects (8). Under these conditions, gastric emptying is always inhibited, with closure of the pylorus and cessation of peristalsis.

When alkaline solutions were tested, it was found that they also exerted a greater effect on the duodenal side of the pylorus. When an isotonic alkaline solution is used, such as 1 per cent sodium bicarbonate, there is little effect on the duodenal mechanism, and the variation in the response to stimulation depends on the gastric acid secretion characteristic of the individual. In an average person with normal gastric acid secretion, gastric evacuation is

hastened. This might be explained by the fact that each trial portion of acid gastric contents, as it enters the duodenum, is rapidly neutralized by the alkaline solution dripped into the duodenum, and this prevents stimulation of the duodenal mechanism. On the other hand, when a markedly hypertonic alkaline solution is used, such as a 5 per cent solution of sodium bicarbonate, the duodenal mechanism is always stimulated so intensely that nothing leaves the stomach, and this occurs regardless of the concentration of acid secreted by the stomach (Fig. 2). The same reaction was found to take place with other hypertonic electrolytes, such as solutions of sodium chloride. Hypertonic solutions of non-electrolytes were found (4, 11) to produce similar effects (Fig. 3).

In other experiments (5) fats and fatty acids were found to be the most powerful stimulants of the duodenal mechanism, and this property of fats is important in understanding the basic part played by milk and cream in the treatment of duodenal ulcer (Fig. 4).

Once the duodenal mechanism has been stimulated, whether by acids, hypertonic



Fig. 3. Hypertonic electrolytes and non-electrolytes stimulate the duodenal mechanism, which results in retardation of gastric emptying.

solutions of electrolytes or non-electrolytes, fats or fatty acids, and regardless of the different physiologic actions of these substances, the effects on gastric peristalsis and the action of the pylorus are always the same. Gastric peristalsis abates, the py-

lorus contracts, and emptying becomes retarded or ceases. The more intense the activator of the duodenal mechanism, the more marked is the pylorospasm and the more retarded is gastric emptying.

To determine further whether this is

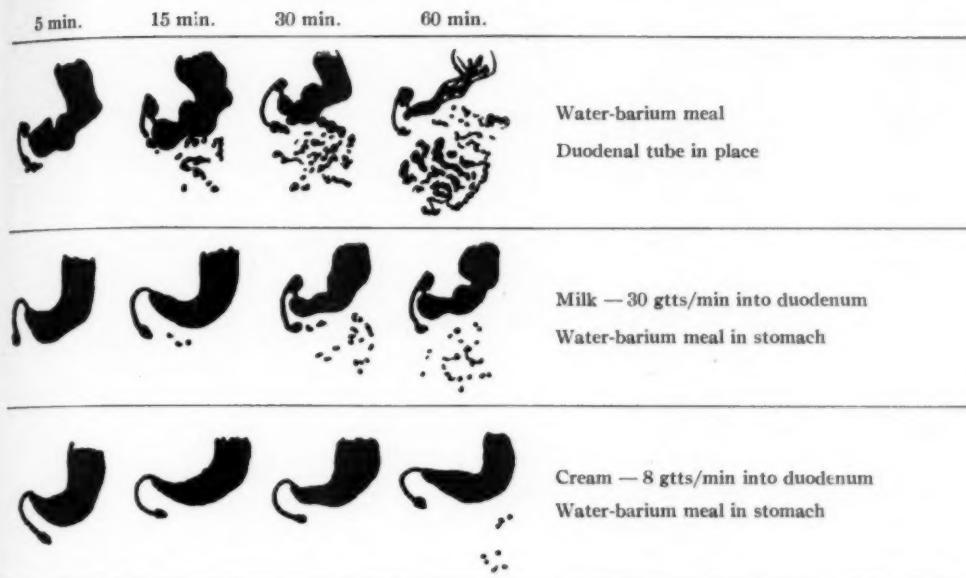


Fig. 4. Milk and cream are active stimulators of the duodenal mechanism, which results in closure of the pylorus, cessation of gastric peristalsis, and retention of the gastric meal. The intensity of stimulation depends chiefly on the fat content of the milk or cream.

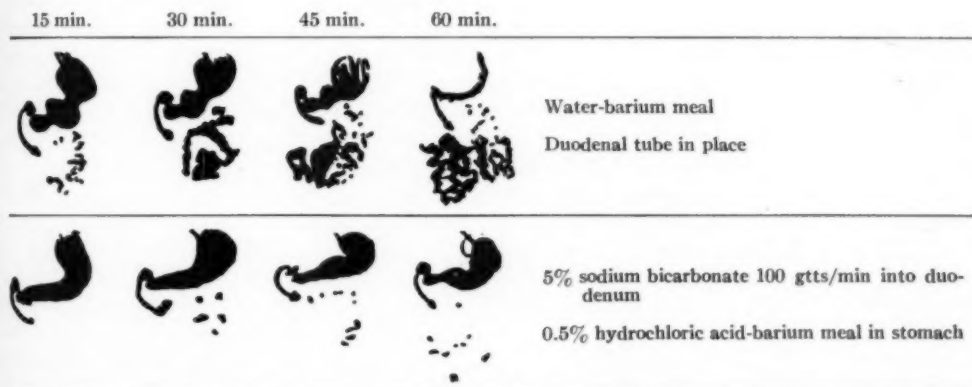


Fig. 5. Acid on the gastric side causes opening of the pylorus, according to Cannon's theory, but tight closure of this sphincter results when a hypertonic alkaline solution is placed in the duodenum, regardless of the presence of an acid solution on the gastric side of the pylorus.

true in the presence of acid on the gastric side of the pylorus, in line with Cannon's theory, the following experiment was done in man. A hypertonic solution of 5 per cent sodium bicarbonate was dripped slowly into the duodenum. Then the gastric side of the pylorus was bathed by a 0.5 per cent hydrochloric acid meal,

but even though this arrangement was ideal for opening the pylorus according to Cannon's theory, gastric emptying was completely prevented. So long as the hypertonic alkaline solution was dripped into the duodenum, the pylorus remained tightly closed, gastric peristalsis remained in abeyance, and no evacuation of the acid

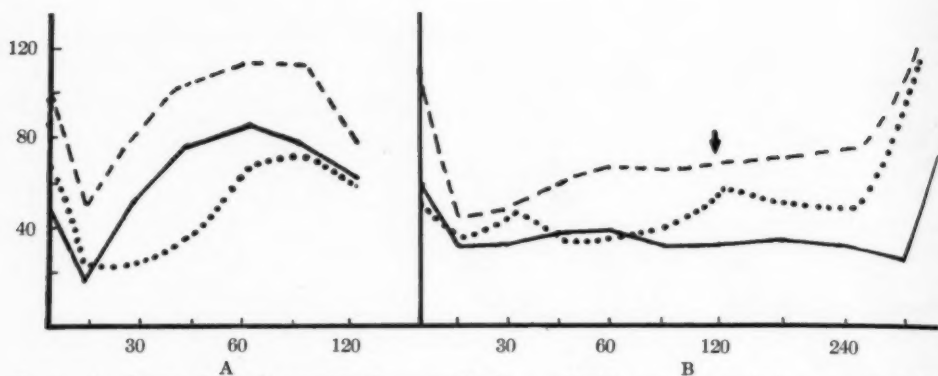


Fig. 6. A. Curves of gastric secretion of — total acid, --- chloride, and . . . pepsin in a normal individual. B. Suppression of gastric secretions when the duodenal mechanism is stimulated by olive oil (40 gtt/min; Ewald meal by mouth). Oil stopped at point indicated by arrow.

meal took place from the stomach (Fig. 5). Thus it would seem that it is the reaction on the duodenal side rather than gastric side of the pylorus which governs gastric emptying.

Stimulation of the duodenal mechanism produces not only pyloric closure and cessation of gastric peristalsis, but also diminution of gastric secretions, including acid, enzymes, and chlorides (10). This depression of secretion continues for a considerable period after the instillation of the stimulant has been stopped. Figure 6 illustrates this depression when olive oil at 40 gtt./min. is instilled into the duodenum. The marked depression of all gastric secretions thus produced is followed by a sharp secondary rise after the effect of stimulation of the duodenal mechanism wears off.

THE DUODENAL MECHANISM IN DUODENAL ULCER

The response of the duodenal mechanism is most sensitive in the duodenal cap. The experiments which led to this conclusion revealed that the activation of this mechanism could be set up from any portion of the small intestine, but that the sensitivity of response decreased rapidly beyond the duodenal cap (8, 10). Ulcer of the duodenum is localized usually in the cap and, since this portion is the most responsive to stimulation, it can be appre-

ciated why duodenal ulcer so consistently causes alterations in the function of the duodenal mechanism. If the duodenum is inflamed, normal stimuli seem to be insufficient for activation of the duodenal mechanism. The brake-like effect on gastric emptying caused by normal stimulation of the duodenal mechanism is not initiated, and rapid gastric emptying takes place. After healing of a duodenal ulcer, normal sensitivity to stimulation is recovered by the duodenum, and the gastric motor disturbances associated with the ulcer disappear.

Likewise, during the active phase of a duodenal ulcer, when the threshold sensitivity of the duodenum seems impaired by the inflammatory processes, the peak gastric acid secretion induced by an Ewald meal is not sufficient to activate the duodenal mechanism. This results in a prolonged hypersecretion. Variations in this abnormal secretory curve might be due to differences in extent of the inflammation in the duodenum and thus account for the observation that small duodenal lesions cause a lesser increase in gastric acidity than do larger lesions with much perifocal inflammation (12). The fact that gastric acid levels return to normal when the duodenal ulcer heals may indicate that normal sensitivity of the duodenal mechanism has returned. This has been demonstrated in the dog, where an in-

creased gastric acid response to a test meal produced by mechanical abrasion of the duodenum returned to normal on the ninth or tenth day, at which time the lesion was found at autopsy to have healed (7). In man, the reappearance of normal gastric motor activity and a normal acid secretory curve perhaps should be regarded as a more reliable indicator of complete healing of an ulcer than any other evidence obtainable (1). Reliance upon this evidence might lead to a better understanding of the numerous so-called recurrences which have come to be expected with the medical treatment of duodenal ulcer. It may be that most of these so-called recurrences are only exacerbations of incompletely healed lesions (6).

In the medical treatment of duodenal ulcer, milk and cream are the mainstays of the diet (3). If gastric hydrochloric acid and pepsin are important ulcerogenous factors contributing to the chronicity of ulcer, if not the prime initiator of this lesion, then the neutralization of the acid and the binding of the pepsin become of paramount importance. For this purpose, milk is an ideal food because its protein will bind pepsin and its buffer action in neutralizing acidity takes care of the hyperacidity. Fats are the most potent stimulants of the duodenal mechanism, and the fat content of milk and cream is well suited for effective activation of the duodenal mechanism when it is obtunded by the inflammatory process of duodenal ulcer. If the duodenal mechanism fails to respond to the fats in milk and cream, with persistence of abnormal gastric motor and secretory functions, even though there is a disappearance of symptoms and the ulcer niche in the x-ray films, the roentgenologist would seem well advised to guard his opinion about the healed state of an ulcer.

SUMMARY

1. The duodenum houses a mechanism influencing tone, peristalsis, pyloric action, and secretions of the stomach.
2. This mechanism can be activated

normally by gastric hydrochloric acid or by other chemical or physico-chemical substances such as hypertonic solutions of electrolytes or non-electrolytes, fats and fatty acids.

3. Stimulation of this mechanism by any of these agents produces suppression or cessation of gastric secretions, lowering of gastric tone, disappearance of gastric peristalsis, closure of the pyloric sphincter, and thus retardation of gastric emptying.

4. A critical threshold level of stimulation of the duodenal mechanism regulates the peak of gastric acid secretion. Because this threshold level is altered by the inflammatory processes of duodenal ulcer, characteristic disturbances in gastric motor and secretory activities take place.

5. Fat is the most potent stimulator of the duodenal mechanism and accounts chiefly for the value of milk and cream in the medical treatment of duodenal ulcer.

6. Disturbances in the duodenal mechanism persisting after the disappearance of symptoms and the ulcer niche in the x-ray films, should put the roentgenologist on guard against reporting the complete healing of duodenal ulcer.

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Pericardial Celomic Cysts¹

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IN THE PRESIDENTIAL address before the Twenty-Third Annual Meeting of the American Association for Thoracic Surgery at Cleveland in 1940, Lambert (1) spoke on "The Etiology of Thin-Walled Thoracic Cysts." Although his discussion was based on only four cases, two from the literature (2, 3) and two which had been reported to him by other surgeons (F.B. Berry and E.F. Butler), his explanation and name for this type of mediastinal cyst has been accepted without dissent.

An excellent review of cysts and cystic tumors of the mediastinum is that of Laipply (4). He listed eight kinds of congenital cysts: epidermoid, dermoid, teratoid, bronchial, esophageal, gastro-enteric and pericardial celomic cysts, and cystic lymphangioma. Only the last two, which are of purely mesodermal origin, will be considered here. These differ considerably in gross and histologic morphology. The cystic lymphangiomas have a complicated structure; they are multilocular and the cyst walls are of varying thickness. Sections of one such specimen (5) showed hyaline fibrous tissue with scattered clusters of fat cells, foci of lymphocytes, blood vessels, areas of smooth muscle fibers, and cystic spaces of various sizes lined with a single layer of flattened endothelium. As Lambert pointed out, the lymphangiomas are intimately incorporated with the surrounding structures, they receive their blood supply from all sides, and cannot be shelled out. Attempts at removal are often associated with severe hemorrhage. The infiltration gives the impression that they are of neoplastic origin. They may occur in any region of the thorax and elsewhere in the body.

On the other hand, those cysts which Lambert has named "pericardial celomic

cysts" are simple in structure. They are usually unilocular and are lined with a thin layer of mesothelium, which peels readily from the surrounding structures. The contained fluid is clear or sanguineous. The four cysts previously described and the one reported here have been adjacent to the pericardium. Lambert's explanation for these cysts is based on a consideration of the embryology of the pericardium. This structure arises from a series of disconnected lacunae which appear early in the life of the embryo. These lacunae in the mesenchyme remain for a time as individual spaces, but eventually coalesce to form the pericardial celom. If one of these lacunar cavities failed to merge, it could persist and give rise to a cyst in the vicinity of the pericardium, a pericardial celomic cyst.

Since only four cases have been reported, they can be reviewed briefly. Dufour and Mourrut (2) published the autopsy findings in a woman who died at the age of eighty-six years of cerebral softening. In the anterior mediastinum, in relation to the superior part of the pericardium, was a cyst containing 120 c.c. of reddish fluid. It was called a "lymphatic cyst." Pickhardt (3) removed a simple cyst measuring 8.9 cm. in diameter from the region of the diaphragm and pericardium of a fifty-three-year-old woman. There was also a smaller cyst, measuring 1.5 cm. in diameter. The two cysts described by Lambert (1) were similar. They had not produced symptoms and were removed after their presence was discovered on routine x-ray examination. One of them, which was removed by Dr. Ethan Flagg Butler, was described as follows: "Arising from the left anterior mediastinal diaphragmatic angle was a thin-walled cyst containing clear fluid,

¹ From the Division of General Surgery of the Henry Ford Hospital, Detroit, Mich. Accepted for publication in June 1946.

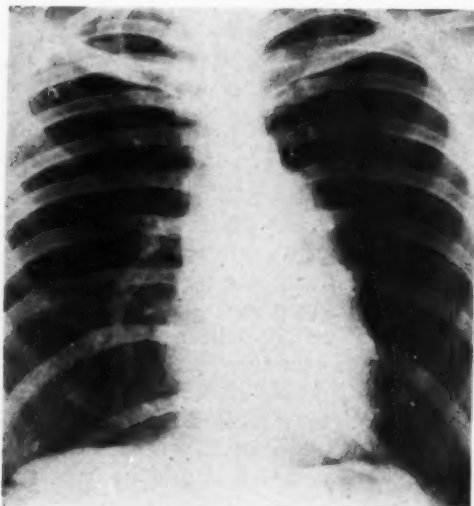


Fig. 1. Roentgenogram of chest made Sept. 17, 1935. Note the thin, curved shadow overlying the arch of the aorta.

approximately 12.5 cm. long by 5 cm. in diameter. If there was any vascular pedicle at all, it came from the diaphragm. It lay adjacent to but was not attached to the pericardium. As it bulged into the pleural cavity, it carried a coat of pleura with it. Its origin was definitely extra-pleural."

Two years ago, I had the opportunity to remove one of these pericardial celomic cysts. The case is of interest because it presented diagnostic difficulties which prevented the true nature of the disorder from being disclosed until operation, although symptoms had been present for ten years, and because the cyst was considerably larger than any thus far reported.

CASE REPORT

Mrs. E. P., a white woman, age 39, was admitted to the Henry Ford Hospital March 12, 1944. Her chief complaints were listed as low-grade fever of ten years' duration, shortness of breath and fatigue, and angina pectoris. She had been presumed to have heart disease for many years. When she was twelve years old, the family physician told her she had a "leaky valve." At the age of fifteen, she was advised not to become a nurse because of her heart. In 1934, when she was twenty-nine, she was obliged to discontinue her studies in a university because of poor health. She tried to do light work on the staff of

a newspaper but could not continue. In 1935, she had a thorough examination in a university clinic. The roentgenogram shown in Fig. 1 was made. This was interpreted as follows: "... The cardiac contour is very unusual, with marked bulging in the region of the left pulmonary artery and the left auricular salient. The aortic arch is not well developed and the appearance is most suggestive of a congenital heart ... There are changes pointing definitely to an accentuated collateral circulation. This warrants a roentgen diagnosis of coarctation of the aorta."

The cardiologist in that clinic disagreed with the diagnosis of coarctation and stated: "I have reviewed the films personally... and we agreed that the peculiar bulge in the region of the upper left mediastinum appeared to be a part of the heart shadow. I could find absolutely no physical evidence of any valve lesion or other cardiac lesion. The x-ray appearance, if the shadow is cardiac, can only be explained as a congenital anomaly. Clinically, one can be certain that it is not a coarctation of the aorta because of perfectly good pulsations in the abdominal aorta and the lower extremities." The patient was advised that the anomaly could be disregarded from a practical standpoint. No cause could be found for the low-grade fever which she had even at that time; it was suggested that it might be due to a functional disturbance of the heat-regulating center in the central nervous system.

From 1936 until 1944, the patient was under the care of another cardiologist. During that time, she carried the diagnosis of congenital heart disease. Roentgenograms taken in August 1938 (Fig. 2) showed a significant increase in the size of the apparent cardiac shadow. Beginning in 1941, severe anginal attacks occurred, which required morphine for relief. The shadow in the chest became alarmingly large (Fig. 3). The patient gradually became completely incapacitated and during the year preceding her admission to the Henry Ford Hospital she was in bed most of the time. She had continued to have fever intermittently.

The clinical studies in the Henry Ford Hospital were under the direction of Dr. Robert Ziegler. The findings on physical examination were not striking. The patient was well developed and nourished. The lungs were clear. Percussion of the heart showed enlargement of the area of cardiac dullness to the right. The rhythm was regular. The mitral first sound was described as rough; there was no definite murmur. The blood pressure was 130/90. The venous pressure was 18 cm. of water. Circulation time with decholin was 15 seconds; with ether 9 seconds. The electrocardiogram showed slight left axis deviation. Fluoroscopy of the heart indicated a transverse diameter of the chest of 28 cm. and of the supposed cardiac shadow of 21.4 cm., as compared with a predicted transverse cardiac diameter of 12.3 cm.

Roentgen examination of the chest included films made with the patient in the postero-anterior, left anterior oblique, and right lateral positions (Fig. 4).

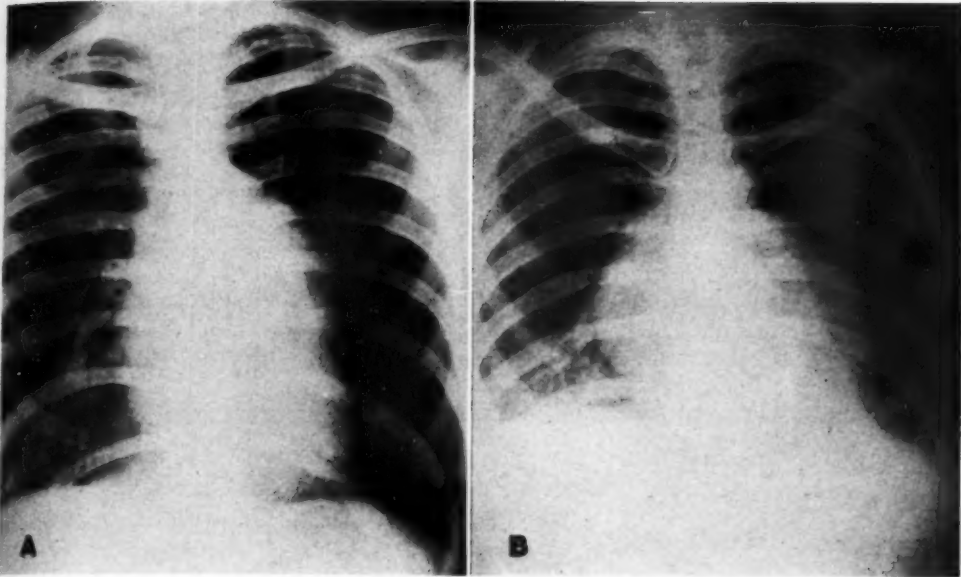


Fig. 2. Roentgenograms taken Aug. 22, 1938, in inspiration (A) and expiration (B).

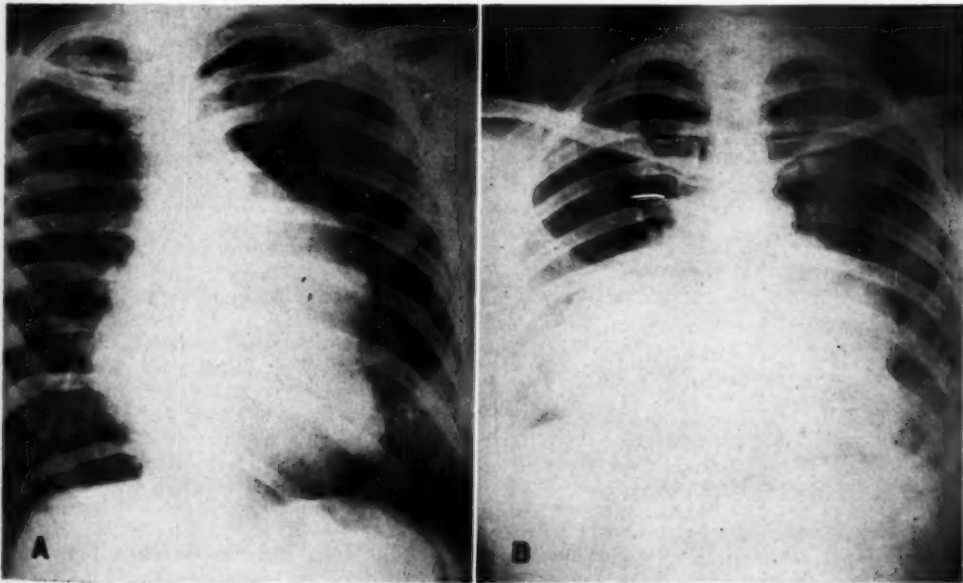


Fig. 3. Roentgenograms taken April 14, 1942, in inspiration (A) and expiration (B).

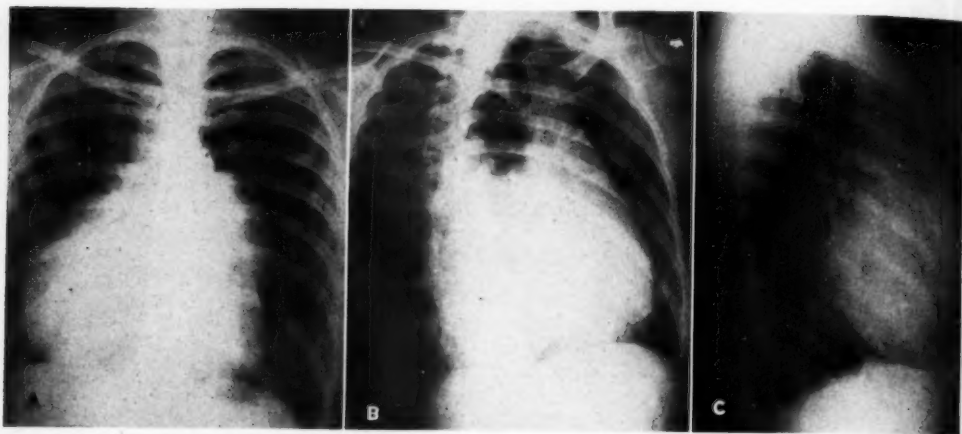


Fig. 4. Roentgenograms of chest taken on March 13, 1944. A. Postero-anterior. B. Left anterior oblique. C. Right lateral.

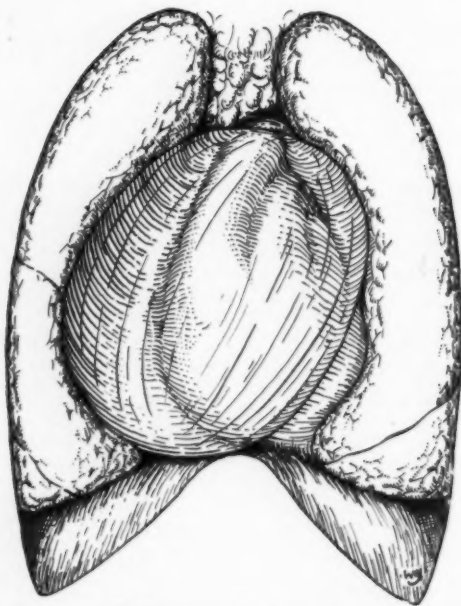


Fig. 5. Semidiagrammatic impression of the unopened cyst as it would have appeared if the anterior thoracic wall had been lifted away.

The roentgenologist reported as follows: "There is evidence of a large shadow of increased density occupying the lower portion of the chest, partly obliterating the heart shadow. This extends out on the left side from an area in the region of the aortic knuckle down to about the tenth interspace posteriorly. There is also a large shadow of increased density extending out into the right chest, especially at the base of the chest. In the oblique position and in the

lateral position, this seems to lie in the posterior portion of the chest. Fluoroscopically, no pulsation of the mass is seen. The cardiac shadow pulsates in a normal manner. *Impression:* These findings suggest a large tumor overlying part of the heart and slightly posterior to it. We could not definitely say what type of tumor this is. From its size, the possibility of lymphoblastoma or of some large cyst would have to be considered."

Operation was carried out on May 17, 1944. The thorax was entered through an incision in the sixth interspace on the right. When the lung was retracted to reveal the tumor, the latter was found to be a huge thin-walled cyst lying in the mediastinum anterior to the heart and great vessels. It projected out around the heart so far on the right that a portion of it actually lay in a plane posterior to the heart, accounting for the roentgen picture in the lateral projection (Fig. 4, C). The pleura over the cyst was carefully incised, after which an excellent plane of cleavage between the pleura and the cyst wall was easily developed. It was thought that it might be possible to excise the cyst intact but, before the dissection had progressed very far, the thin wall ruptured and permitted about a liter of clear straw-colored fluid to escape. After the removal of the fluid from the pleural cavity by suction, it was found that the removal of the cyst was greatly facilitated by the evacuation of its contents. The hand could be placed inside the structure, and exploration revealed that it extended over the entire anterior surface of the pericardium and great vessels (Fig. 5). The outline of the arch of the aorta could be palpated easily. The thin lining of the cyst was stripped out of its position exactly as one would strip out the sac of a large scrotal hernia. No bleeding was encountered, since there was no pedicle or other vascular attachment of importance. After the removal of the cyst lining, the opening in the medi-

astinal pleura fell together and no suturing was done. The condition of the patient following closure of the thoracotomy wound was excellent.

The pathologic report on the excised tissue (by Dr. P. C. Gillette) was as follows: "The specimen consists of three strips of areolar tissue, one side of which is apparently covered with thin epithelium. The pieces cover an area of 10 inches by 15 inches. *Microscopic:* The cyst has no epithelial lining. The wall is composed of areolar tissue throughout which are distributed many vascular channels, some islands of adipose tissue, and some islands of round cells. Nothing specific is noted in the cyst. *Impression:* Simple mediastinal cyst."

The postoperative film of the chest showed an absence of the large shadow seen previously (Fig. 6). The patient was discharged on June 10, 1944. In September, she stated that she felt exceptionally well except for her usual bouts of fever. The cause of these febrile attacks remains unknown in spite of extensive studies.

In retrospect, the roentgenograms of this patient in 1938 and 1942 show a sign which may very well be pathognomonic for a pericardial celomic cyst in this location. This sign is the marked change in the contour of the mass produced by the two phases of respiration (Figs. 2 and 3).

SUMMARY

Attention has been directed to a type of mediastinal cyst which has been called pericardial celomic by Lambert. A case report of a patient who had an unusually large cyst of this kind has been presented. Roentgenograms showing the cyst at various stages of development were available.

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Fig. 6. Roentgenogram of chest soon after operation. Note the unhealed osteotomies of the sixth and seventh ribs on the right.

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Gastrocolic Fistula Complicating Carcinoma of the Colon

A Case Report¹

MAJ. PETER ZANCA, M.C., A.U.S.

GASTROCOLIC FISTULA has long been established as a distinct clinical entity. Although it is rare in occurrence, many isolated cases have been reported in the literature. The condition exists only as a complication to other primary gastrointestinal or intra-abdominal lesions.

The characteristic symptoms of gastrocolic fistula are fecal vomiting in the absence of symptoms of intestinal obstruction, eructation of foul gas, a fecal odor to the breath, general weakness, extreme loss of weight, and persistent diarrhea with undigested food particles in the stools. The diagnosis can safely be made when fecal vomiting occurs in the absence of intestinal obstruction. However, because of the variable symptomatology resulting from the different primary lesions, clinical diagnosis sometimes becomes difficult and roentgen study may be required. By means of the barium meal, barium enema, and double contrast enema the diagnosis of gastrocolic fistula can be established easily and definitely.

CASE REPORT

A 37-year-old white male was admitted to the Station Hospital on March 14, 1946, complaining of rectal bleeding, abdominal pain, diarrhea, general weakness, and a mass in the left upper abdomen.

Past History: The patient had always been well and had worked as a waiter for nine years prior to induction into the Army in 1942. After eight months of military service he was discharged for severe varicose veins of both lower extremities. A chronic alcoholic, he drank a pint of whisky and consumed one to two packages of cigarettes daily. He denied having had any venereal disease.

The family history was essentially negative.

History of Present Illness: Seven months prior to admission the patient had an attack of severe abdominal pain and cramps. Treated symptomatically, he improved and returned to work in one week. From that time on, he had had recurrent attacks of abdominal pain, showing no relation to meals. His appetite was extremely poor and he preferred drink-



Fig. 1. Gastrocolic fistula secondary to carcinoma of the colon, demonstrated following a barium meal examination. There is a broad, irregular communication between the stomach and colon.

ing to eating. On two or three occasions after the middle of February 1946, there had been vomiting of some coffee-ground material and dark bloody streaks had been observed in the stools. In the early part of February, the patient noticed a large mass in the left upper abdomen which was somewhat annoying but not painful. His bowel movements had been regular until diarrhea developed two days prior to admission to the hospital. He had been steadily losing weight and had grown progressively weaker. On admission he was unable to stand.

On *physical examination*, the patient appeared critically ill. He was very pale, weak, dehydrated, and cachectic. His blood pressure was 108/58, pulse 112, respirations 22, and temperature 99.4°. The abdomen was slightly distended, and in the left upper quadrant, just beneath the anterior costal margin, was a smooth, rounded mass, about 8 cm. in diameter, which was mildly tender on palpation. Several small, shotty, freely movable, non-tender axillary and inguinal nodes were present. Otherwise, the physical findings were normal.

¹ From the Roentgenological Service, Station Hospital, West Point, N. Y. Accepted for publication in June 1946.

Laboratory Data: On admission blood studies showed red cells 2,330,000; hemoglobin 5.8 gm.; white cells 15,400 (neutrophils 84 per cent, lymphocytes 11 per cent); platelet count 260,000. There were marked hypochromia and anisocytosis. Clotting time was 3 minutes; bleeding time 1.5 minutes. Serum protein was 6.3 gm. per 100 c.c. The Kahn



Fig. 2. Film made following a barium meal. The opaque medium can be seen filling the fistulous tract and emptying into the colon. The gastric rugae are coarse and irregular. There is a partial filling of the stomach and of the duodenal bulb.

reaction was negative. Occult blood (+++) was present in the stool. Urinalysis was negative. Gastric analysis showed a total acidity of 130 and free hydrochloric acid 110, following histamine.

X-ray Findings: Fluoroscopically the esophagus appeared normal. There was immediate filling of the descending colon, and only a small portion of the barium meal passed into the duodenum, outlining a normal duodenal bulb. There was an irregular filling defect of the pars media, involving the greater curvature of the stomach. The barium passed from this region through a long, irregular tract into the splenic flexure of the colon. The greater part of the gastric mucosa appeared coarse and irregular. Films (Figs. 1 and 2) confirmed the fluoroscopic findings. At six hours, there was no gastric residue, and the head of the barium was in the cecum. The gastrocolic tract remained filled with the opaque medium; the distal third of the transverse colon and the upper portion of the descending colon were also filled with barium.

Following a *barium enema*, there was normal filling

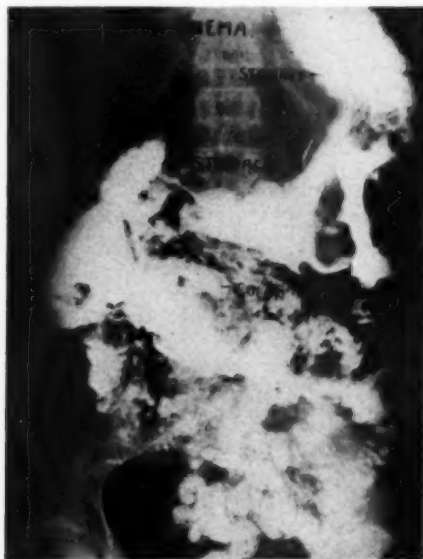


Fig. 3. Barium enema study. Note filling defect in region of greater curvature of stomach. The fistula can be seen leading from this defect to the colon. An irregular filling defect and constriction of the splenic flexure are also seen.

of the rectum and descending colon to the level of the splenic flexure. A small part of the barium passed through the transverse colon into the ascending colon and to the cecum. An irregular filling defect and constriction in the region of the splenic flexure, from which a stream of barium extended upward into the midportion of the stomach, was seen (Fig. 3), and a firm, non-tender, abdominal mass could be palpated in this region. Except for a small area in the pars media, the stomach also filled with barium, and a smaller amount of the opaque medium passed into the duodenum.

After evacuation of the barium, *air* was injected into the colon and a gastrocolic communication was plainly visualized (Fig. 4). A moderate amount of gas could be seen throughout the colon, stomach, and duodenum.

A roentgenogram of the chest was negative.

Diagnosis of gastrocolic fistula secondary to carcinoma of the stomach and colon was made. The patient received 1,050 c.c. of whole, citrated blood, there was improvement in his general condition, and operation was performed on April 10, 1946, by Lt. Col. H. Genvert.

Operative Findings: In the left upper quadrant there was a large adherent mass which involved the greater portion of the posterior wall of the stomach and the distal end of the transverse colon, including the splenic flexure. The mass was fixed to the body of the pancreas and to the retroperitoneal nodes. There was no evidence of metastasis to the



Fig. 4. Roentgenogram obtained following partial evacuation of the barium and injection of air into the colon. Note the air in the descending colon. The fistulous tract is clearly outlined and there is a partial filling of the stomach with gas.

liver, and the pelvis was negative. A gastric resection and a resection of the splenic flexure were performed. A Polya anterior gastro-enterostomy and an end-to-end anastomosis of the transverse colon to the descending colon completed the operation.

Pathological Findings: The gross specimen (Fig. 5), consisting of a portion of resected stomach and colon, measured approximately 15×20 cm. The stomach and colon were densely attached to each other by a firm mass measuring 8 cm. in its greatest diameter. When the stomach was opened (Fig. 6, A), there were found two openings along the greater curvature, the larger measuring 1.5 cm. in diameter and leading into one fistulous tract, which communicated with the colon. On opening the colon (Fig. 6, B), there was found an annular ulcerated neoplasm at the base of which was the opening of the fistula. The fistulous tract was lined with tumor tissue. Microscopic examination revealed an adenocarcinoma of the colon. Sections through the fistulous tract showed it to consist of carcinomatous material. The stomach wall was infiltrated from without.

Progress of Case: The patient received 1,500 c.c. of whole, citrated blood following operation, and on April 25 the blood count was: red cells 3,690,000; white cells 13,000 (neutrophils 67 per cent; lymphocytes 7 per cent; eosinophils 2 per cent; stab

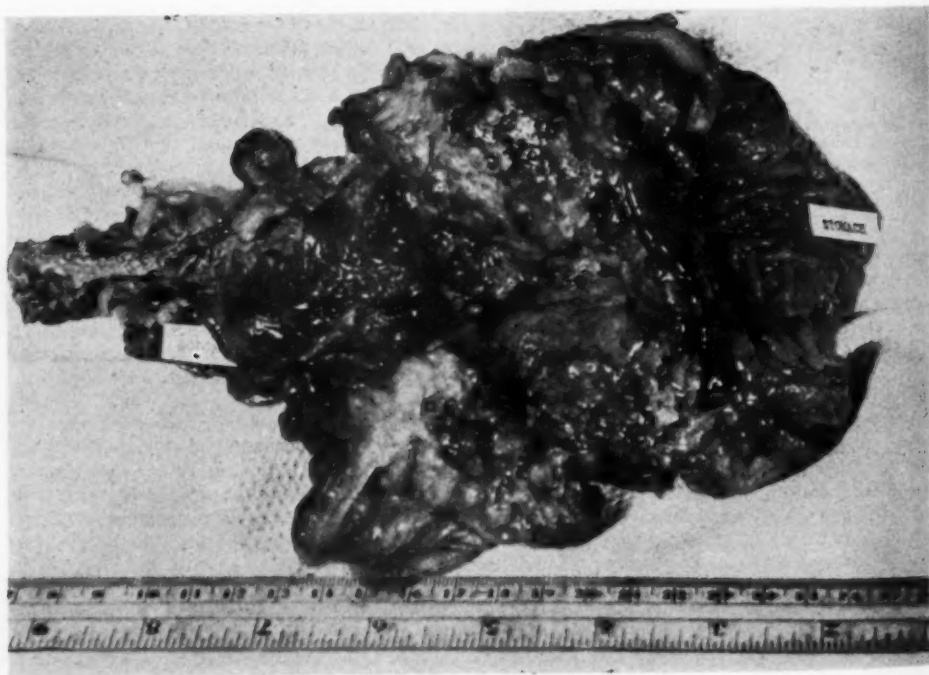


Fig. 5. Stomach, fistulous tract, and colon, showing the communication between the two organs. The tract measures about 5.5 cm. in length and is composed entirely of neoplastic tissue.

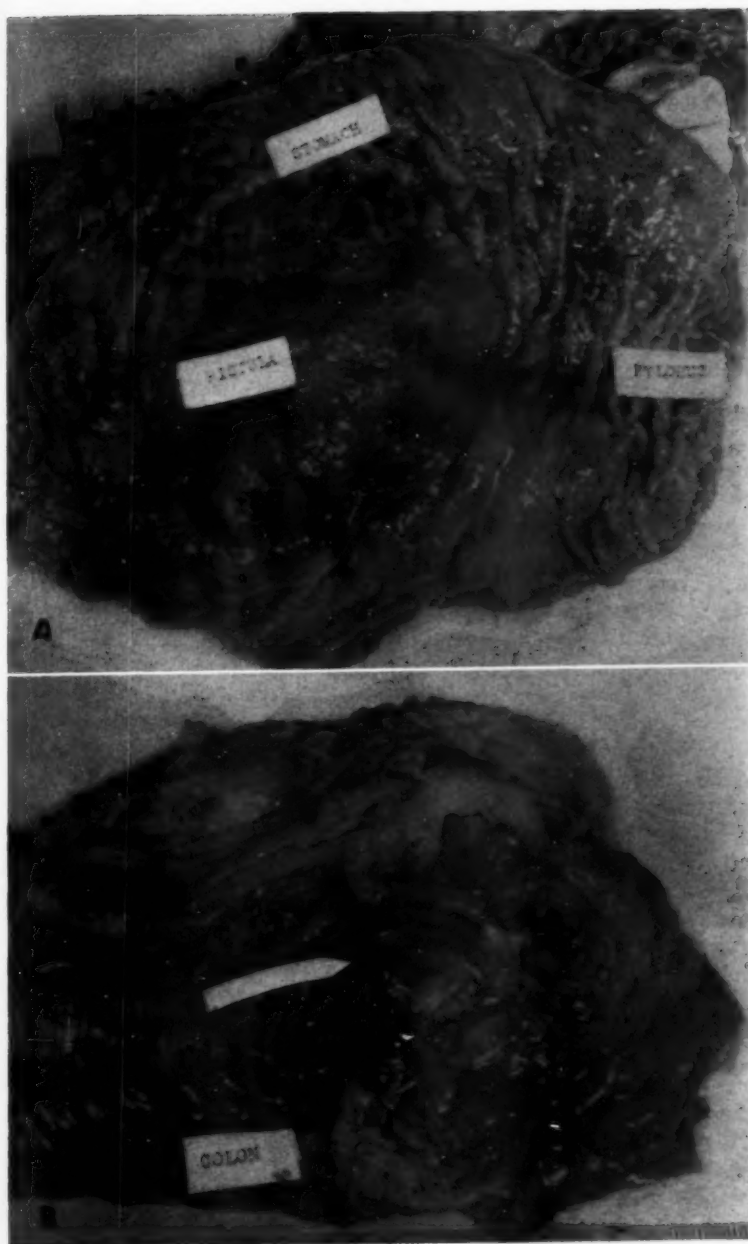


Fig. 6. A. Stomach opened, showing the two fistulous openings; the darker rounded opening is the lesser one and communicates with the major fistulous tract about 1 cm. from its gastric end.

B. Transverse colon, open, showing annular ulcerating carcinoma of the colon. Arrow points to the fistulous opening at the base of the tumor.

forms 19 per cent; juvenile forms 2 per cent; myelocytes 3 per cent). Hemoglobin was 9.5 grams. On the third postoperative day a post-anesthetic pneumonia and pleurisy with effusion developed. The condition, however, improved rapidly and on May 5, 1946, the patient was up and around. At the time of this report he is eating well, has gained ten pounds, has no complaints, and is awaiting discharge from the hospital.

DISCUSSION

An intra-abdominal mass, rectal bleeding, abdominal pain, diarrhea, severe weight loss, anemia, and general weakness were among the symptoms which suggested gastro-intestinal disease, clinically. The pathognomonic signs of foul breath and of fecal vomiting were not present and the diagnosis was deferred until an x-ray study was done. Any or all of the symptoms present in this case may occur in the presence of a solitary primary lesion. The history of chronic alcoholism, the moderate gastric complaints, and the anemia served only to mask the cardinal symptoms of the disease.

Roentgen examinations with the aid of a barium meal, barium enema, and double contrast enema, in each instance conclusively demonstrated the presence of a gastrocolic fistulous tract. At the same time, the filling defects of the stomach and colon suggested the existence of the underlying primary cancer. The fistulous tract was the result of chronic invasion of the stomach wall by neoplastic tissues from the splenic flexure of the colon. This large opening easily allowed the opaque medium to flow from the stomach directly into the colon during the barium meal examination. The flow of barium from the colon into the stomach during the enema was also easily accomplished.

In the presence of a ball-valve type of fistula, routine study of the gastro-intestinal tract may not suffice in demonstrating the presence of perforation. It is, important, therefore, to include the double contrast enema as part of the roentgen examination. The entire fistulous communication will be visualized after the colon has

been inflated with air. This procedure will also permit the radiologist to detect the foul and fecaloid odor emanating from the patient's mouth.

The prognosis in this type of case is poor. Surgery will afford immediate relief, however, and the patient may look forward to several symptomless years.

SUMMARY

A case of gastrocolic fistula secondary to carcinoma of the colon is reported.

Clinical diagnosis of gastrocolic fistula is difficult to make because of the variable symptoms dependent upon the primary lesion, or absence of symptoms altogether.

Complete x-ray studies of the gastro-intestinal tract by means of barium meal, barium enema, and double contrast enema, will definitely establish a diagnosis of gastrocolic fistula.

NOTE: The author wishes to express his thanks to the pathologist, Captain B. Stempel, M.C., for the excellent demonstration of the pathologic specimen, to the Signal Corps Service of West Point for their fine photographs and to the x-ray technicians, Sgt. G. N. Burnett and Mr. Robert E. Hennessey.

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Rheumatic Mitral Valve Disease Without Cardiac Enlargement¹

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IN THE DIAGNOSIS of mitral valve disease, radiologic aid is frequently sought. This is usually based on the various roentgen evidences of change in the size or contour of the heart. Although these observations may be variable and may be simulated by a variety of other conditions (1), the usual teaching at the present time is that telerradiographic examination reveals prominence of the second left cardiac arc due to prominence of the pulmonary artery and the appearance of the conus arteriosus of the right ventricle on the left heart border. Further radiologic examination in the right anterior oblique position, after the administration of a barium bolus, shows posterior displacement of the esophagus, indicative of left atrial dilatation, usually ascribed to the hemodynamic changes caused by the malformation of the mitral valve. Left atrial dilatation is considered by some to be next in importance only to the pathognomonic apical diastolic murmur as a criterion for the diagnosis of mitral valve disease (2).

Various measurements of the frontal silhouette of the heart viewed telerradiographically are often used for the determination of cardiac enlargement. The most reliable of these are the Ungerleider and Gubner charts and nomograms, which are reported to be the only measurements which can identify as little cardiac enlargement as 40 per cent above the normal heart weight (3). Ungerleider presents these methods as two simple and accurate procedures whereby the presence of cardiac enlargement may be determined, and also states that cardiac fluoroscopy is an invaluable aid in the diagnosis of chamber enlargement (4).

Recently mention was made of the fact that dilatation of the left atrium may exist

in certain cases of rheumatic mitral valve disease without visible or arithmetic changes in the frontal silhouette of the heart (5). In these patients left atrial dilatation may be demonstrated only by the posterior displacement of the esophagus viewed in the right anterior oblique position. This was considered to be the earliest radiologic sign of mitral valve disease and incidentally poses the question whether dilatation of any chamber of the heart should not be considered indicative of enlargement, whether or not it might be identified by any of the methods of cardiac mensuration.

The purpose of this communication is to report a group of cases with the classical systolic and diastolic murmurs of mitral valve disease but without any radiologic evidence of cardiac enlargement. These were selected from a larger group with sufficient but not absolutely definite evidence of mitral valve disease. The latter group likewise presented no radiologic evidence of cardiac enlargement. It is emphasized that under these conditions the radiologist should report only that the heart is neither visibly enlarged nor altered in contour; he should not attempt to pass on the existence of organic heart disease on the basis of his findings alone. The advantages of knowing the limitations of any method of examination are obvious (6).

MATERIAL AND OBSERVATIONS

There were 25 patients in this group, in whom the diagnosis of mitral valve disease was made during routine hospital work in approximately four years. Sixteen were in-patients and 9 were referred for examination from the out-patient department. There were 17 females and 8 males, ranging from ten to sixty-three years old.

¹ From the Radiologic Service of M. G. Wasch, M.D., The Jewish Hospital of Brooklyn, Brooklyn, N. Y. Accepted for publication in May 1946.

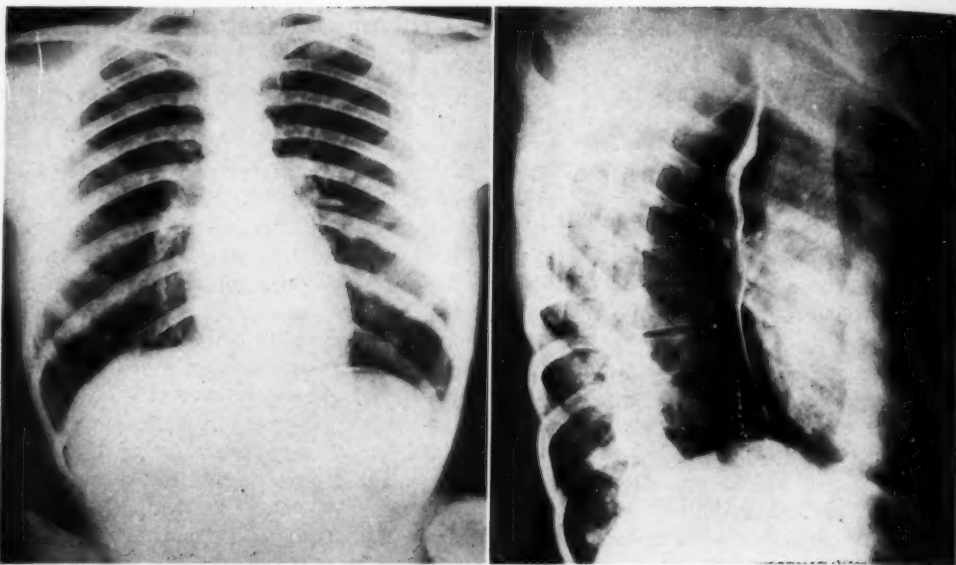


Fig. 1. Case 1. A (left). Teleroentgenogram of the chest; no cardiac enlargement. B (right). Right anterior oblique esophagram; no displacement of the esophagus.

Twenty patients had positive histories of rheumatic fever, 2 had had episodes of chorea only, and 3 had no known rheumatic infection. The duration of known heart disease varied from less than a year in 3 cases to over twenty years. Seventeen patients had been aware of heart disease for more than five years. The murmurs presented by all the patients in the group were considered definitely diagnostic of mitral valve disease. Classical mitral systolic and diastolic murmurs were audible in 20 cases, and in 3 there were variable murmurs, the quality varying from long, loud, blowing apical systolic murmurs to systolic and diastolic murmurs. Two patients, both with subacute bacterial endocarditis, had long, loud, blowing apical systolic murmurs.

The blood pressure readings were within normal limits in the entire group. Electrocardiographic examinations were available in 20 instances and, with the exception of one patient with subacute bacterial endocarditis who had right axis deviation, no significant changes were noted in any of these. Congestive heart failure was not encountered except in one patient who had

dyspnea on exertion during the last trimester of her third pregnancy.

There were 7 patients with proved subacute bacterial endocarditis. Of these, 5 responded to penicillin-heparin therapy administered by Dr. Leo Loewe. Two patients died, but autopsy permission was denied.

Radiologic examinations of the chest included fluoroscopy, teleradiography, and esophagrams in the right anterior oblique position after preliminary fluoroscopic study. The heart contour as viewed on teleradiographic examination in the postero-anterior position was normal in each instance. Measurements made according to the method of Newcomer and Newcomer (7) were normal in every case. Information as to the height and weight was available in 12 cases, and measurements made according to the Ungerleider and Gubner nomograms for the area and transverse diameter of the frontal heart silhouette were normal in these patients. Fluoroscopic examination showed no visible changes in the pulsations of the heart except for some increased activity of pulsation in some of the patients with subacute

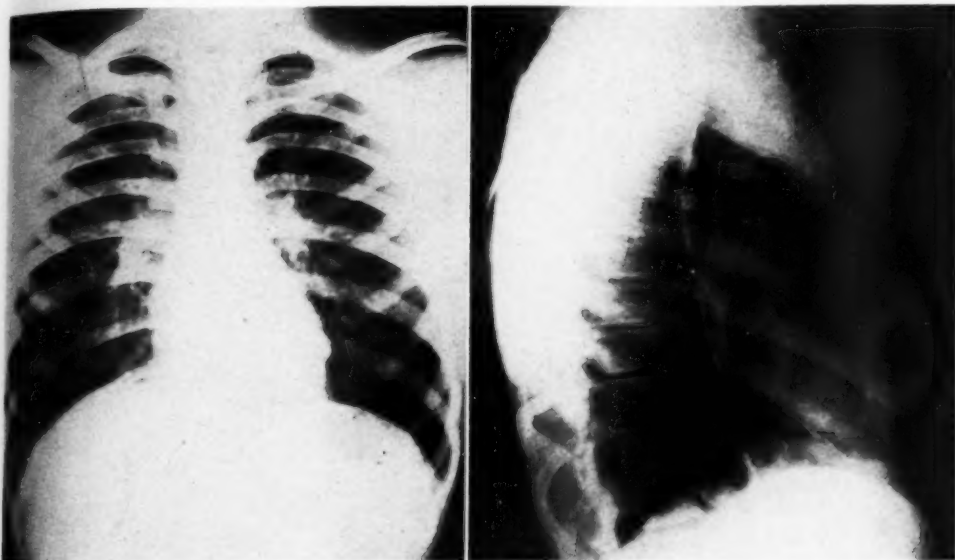


Fig. 2. Case 2. A (left). Teleroentgenogram of the chest; no cardiac enlargement. B (right). Right anterior oblique esophagram; no displacement of the esophagus.

bacterial endocarditis who were quite ill at the time of examination. There was no displacement of the esophagus either dorsally or to the right in any patient in this group, nor was there any displacement of the left main bronchus. None of the patients presented a double right cardiac contour.

The absence of congestive heart failure in this group of patients supports the concept that the heart rarely fails while it is normal in size.

REPORT OF ILLUSTRATIVE CASES

CASE 1. S. D., female, aged 25 years, had chorea at the age of twelve, following which a cardiac murmur was present for one year and then disappeared. She was admitted to the hospital because of anorexia, palpitation of the heart, and a sensation of nervousness and flushing.

Physical examination revealed a presystolic rumble at the apex, especially with the patient in the left lateral position, and a definite presystolic thrill. Blood pressure was 124/60. The rhythm was regular, rate 84 per minute.

Electrocardiographic examination was reported as within normal limits.

Fluoroscopic examination of the heart revealed no evidence of chamber enlargement. The barium-filled esophagus was not shifted from its usual course. The pulsations of the heart and great vessels were

within normal limits. The lungs were clear. Teleroadiographic examination of the chest showed no change of pathologic significance in the heart or lungs.

The patient's height was 157 cm., and her weight was 46 kg. The predicted surface area according to the Ungerleider and Gubner nomogram was 100 sq. cm.; the actual surface area was 94 sq. cm. The predicted transverse diameter was 108 mm.; the actual transverse diameter was 97 mm. The heart-lung ratio was 21 per cent.

The patient was discharged with a diagnosis of a psychosomatic disorder and inactive rheumatic mitral valve disease.

CASE 2. J. M., male, aged 15 years, was referred to the outpatient department for evaluation of his cardiac status. At the age of eleven he had rheumatic fever which confined him to bed for two years. The disease was manifested by intermittent fever with painful swelling of the ankle, wrist, knee, and elbow joints and classical mitral systolic and diastolic murmurs. For the past two years he had been symptom-free, but recently he had experienced palpitation and some shortness of breath on exertion.

Physical examination revealed a loud systolic murmur at the apex with accentuation of the second pulmonic sound. There were no objective evidences of congestive heart failure.

Fluoroscopic and radiographic examination of the chest showed no evidence of alteration of the silhouette of the heart or individual chamber enlargement. The barium-filled esophagus was not deviated from its usual course.

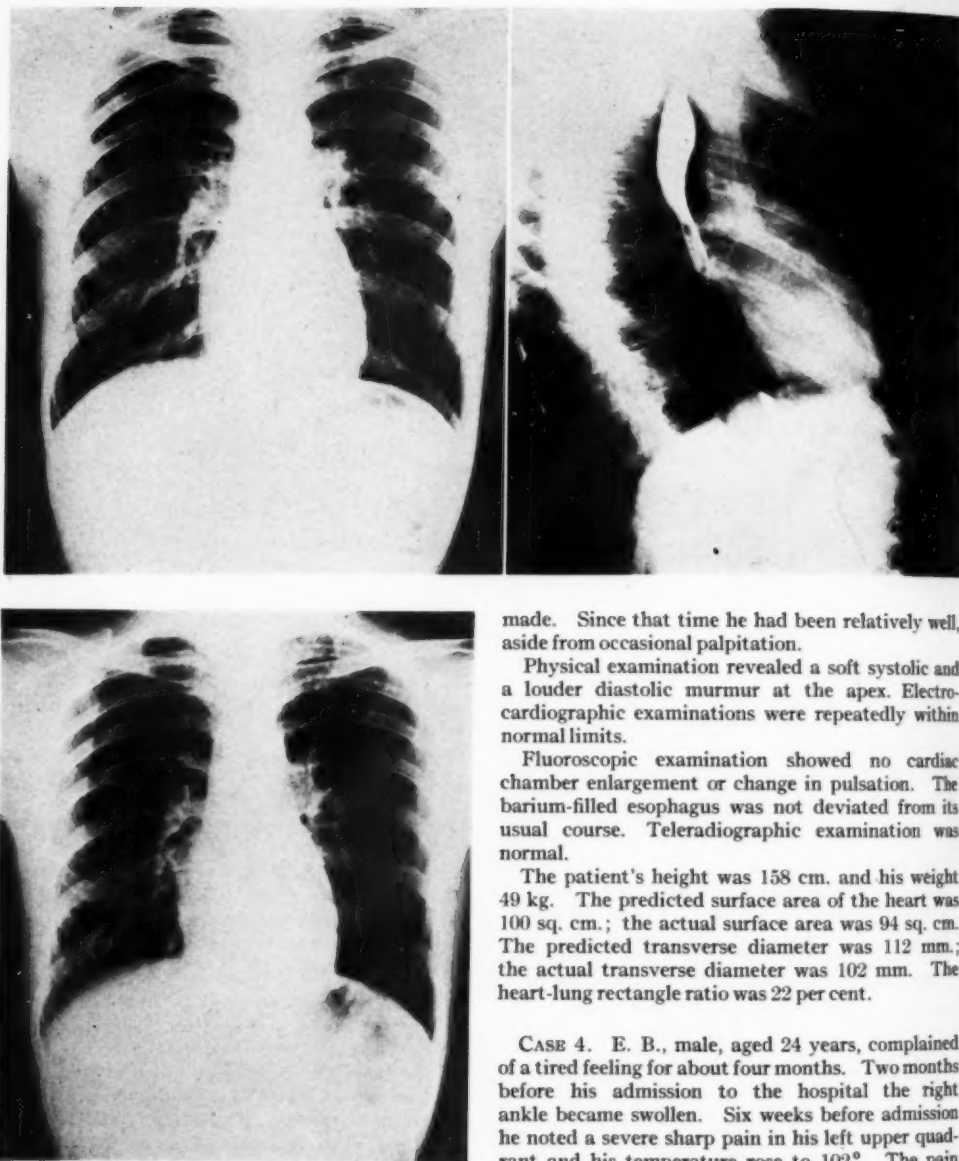


Fig. 3. Case 3. A (upper left). Teleroentgenogram of the chest; no cardiac enlargement. B (right). Right anterior oblique esophagram; no displacement of the esophagus. C (lower left). Teleroentgenogram taken fifteen months after that in A. No change has occurred in the shape or size of the heart.

CASE 3. M. F., male, aged 23 years, had his first rheumatic episode at the age of thirteen years, when he was hospitalized for one year and a diagnosis of mitral valve disease was

made. Since that time he had been relatively well, aside from occasional palpitation.

Physical examination revealed a soft systolic and a louder diastolic murmur at the apex. Electrocardiographic examinations were repeatedly within normal limits.

Fluoroscopic examination showed no cardiac chamber enlargement or change in pulsation. The barium-filled esophagus was not deviated from its usual course. Teleradiographic examination was normal.

The patient's height was 158 cm. and his weight 49 kg. The predicted surface area of the heart was 100 sq. cm.; the actual surface area was 94 sq. cm. The predicted transverse diameter was 112 mm.; the actual transverse diameter was 102 mm. The heart-lung rectangle ratio was 22 per cent.

CASE 4. E. B., male, aged 24 years, complained of a tired feeling for about four months. Two months before his admission to the hospital the right ankle became swollen. Six weeks before admission he noted a severe sharp pain in his left upper quadrant and his temperature rose to 102° . The pain subsided after two days but fever persisted. There had been a weight loss of about 20 pounds in the past three months.

There was no past history of rheumatic fever, and the patient had been completely unaware of any cardiac disease. About two weeks before admission an apical diastolic murmur was heard. Blood culture was positive for *Streptococcus viridans*. Penicillin-heparin therapy was administered, and the patient made a satisfactory recovery. He was discharged ten weeks after admission in good condition.

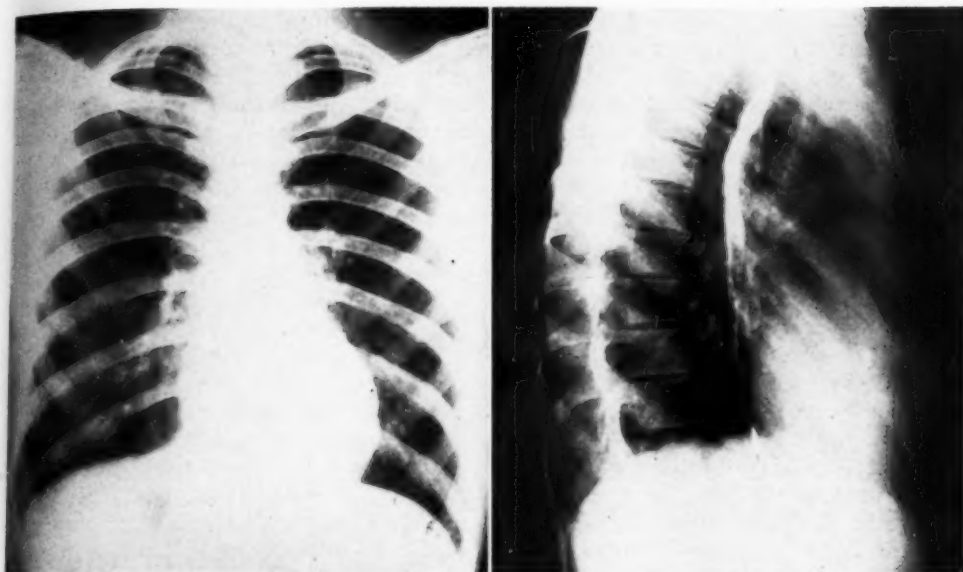


Fig. 4. Case 4. A (right). Teleroentgenogram of the chest; no cardiac enlargement. B (left). Right anterior oblique esophagram; no displacement of the esophagus.

Fluoroscopic and teleradiographic examination of his chest showed no evidence of enlargement of the heart and no change in the normal course of the esophagus.

The patient's height was 178 cm. and his weight 79 kg. The predicted surface area of the heart was 130 sq. cm.; the actual surface area was 118 sq. cm. The predicted transverse diameter of the heart was 133 mm., the actual transverse diameter was 122 mm. The heart-lung rectangle ratio was 24 per cent.

COMMENT

The diagnosis of mitral valve disease sometimes presents perplexing problems to both the internist and the radiologist. In the past, emphasis has been placed mainly upon changes readily identified either clinically or radiologically. Further effort toward the recognition of the earliest changes which occur in the first stages of mitral valve disease, or for that matter of any disease, is essential.

It is important for the radiologist to establish the limitations of his method of examination so that false confidence on the one hand or indifference on the other may be avoided. Only by such evaluation of radiologic examination can its true scope be established.

Bland, Jones and White (8) reported the case of a young woman twenty years old with mitral stenosis who died because of an accident. Her rheumatic infection started at the age of thirteen years, and murmurs of definite mitral and aortic disease had been present and had disappeared during three years of observation. At autopsy her heart weighed 275 gm. and revealed mitral valvulitis without cardiac enlargement. The present author reported the autopsy findings of two patients with rheumatic mitral valve disease, with hearts weighing 140 and 190 gm., respectively, both of whom had minimal left atrial dilatation (5).

It is less well known that advanced mitral valve disease without left atrial dilatation has been found postmortem in patients who had otherwise considerably enlarged hearts. Gouley (9) encountered 7 such instances in a series of 61 cases of mitral stenosis. Schiassi (10) reported two patients with advanced mitral stenosis and congestive heart failure who had no left atrial dilatation but were found to have considerable cardiac enlargement, particularly of the right ventricle at post-

mortem examination. Galavotti (11) reported the autopsy findings of a twenty-three-year old woman who had mitral stenosis, tricuspid stenosis and insufficiency, and slight aortic insufficiency without left atrial dilatation but with marked ventricular enlargement. No mention is made of the radiologic observations in any of these patients.

These are relatively rare occurrences but are cited as evidence that not every case of mitral valve disease, even with the highest degree of stenosis, must necessarily have a dilated left atrium. The reason for these exceptions to the rule is both obscure and challenging.

A systolic and presystolic or diastolic apical murmur is considered definitely diagnostic of mitral valve disease in the vast majority of cases. Nevertheless, similar murmurs, other than Austin Flint murmurs, have been reported in patients with normal mitral valves. These usually occur in the presence of a markedly dilated or enlarged heart. Wood and White (12) commented that diastolic murmurs might occur in certain large hearts with normal valves and thus lead to false diagnoses of mitral stenosis. Robinow and Harper (13) had four patients with acute transient hypertension and nephritis who had mid-diastolic murmurs at the apex simulating mitral stenosis which vanished as their conditions improved. Gunewardene (14) reported pronounced systolic and diastolic apical murmurs with cardiac dilatation due to severe anemia in patients with *Ankylostoma* infections.

This type of pseudo-mitral murmur may readily be distinguished from the cases reported here because in none of the latter was there cardiac enlargement or failure, and the murmurs were much more constant than those encountered in patients with simulated mitral stenosis.

The significance of mitral murmurs during rheumatic activity is often questionable, and prolonged observations may be required before an accurate estimate of the degree of valve damage can be made (15). Taussig (16) has stressed the fact that in

children changes in the size of the heart may show different sequences in the presence of similar valvular lesions, and that the valvular lesions are of lesser importance in the development of cardiac enlargement than is active rheumatic infection. With the cessation of rheumatic activity, it is not uncommon for the cardiac enlargement to recede and for the murmurs to change or disappear. The heart may then adjust itself to whatever valvular damage remains without further increase in size other than that commensurate with normal growth. Clinicians have long been aware of the fact that murmurs are in themselves of less importance than enlargement in the evaluation of cardiac status. Sir Thomas Lewis (17) pointed out that those who relied constantly on cardiac murmurs were always in difficulty when it came to prognosis and treatment, and that those who dealt most efficiently with cardiac patients laid the chief emphasis on other phenomena.

The relatively high incidence of subacute bacterial endocarditis in this group is worthy of thought. These patients were mostly young people who were in good physical condition and were suddenly afflicted with a disease hitherto considered almost uniformly fatal. The absence of cardiac enlargement obviously should not bear any weight in the diagnosis of subacute bacterial endocarditis.

SUMMARY

It is shown that loud and classical apical murmurs diagnostic of mitral valve disease may exist in the absence of cardiac enlargement or changes in the silhouette of the heart, just as it is possible for pronounced cardiac enlargement to be present with minimal and often misinterpreted murmurs. If the murmurs are characteristic, the diagnosis of mitral valve disease must be made even in the absence of any radiologic criteria. Conversely, if there is any enlargement of the heart, the conclusion that organic heart disease is present must be reached. In the diagnosis of mitral valve disease the demonstration of left atrial dilatation is the earliest radio-

logic sign. This may be obtained in patients with murmurs which by all description should be considered functional. On the other hand, there are many patients with classical mitral disease as indicated by pathognomonic murmurs who have no visible cardiac enlargement. There is also a small group of patients with mitral stenosis who have cardiac enlargement without left atrial dilatation.

It should be recognized by both the radiologist and the clinician that in mitral valve disease there may be no visible alteration in the radiographic appearance of the heart, just as murmurs may be absent or atypical.

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Unilateral Paraspinal Abscess¹

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IN THE PAST several years attention has been drawn to an important anatomical landmark in the study of lesions of the thoracic spine known as the linear thoracic paraspinal shadow or posteromesial pleural line (1, 4, 5, 6). In many lesions of the thoracic spine there is found to be a fusiform shadow produced by lateral displacement of the pleural borders which aids materially in the diagnosis of spinal disease in this region. It is the purpose of this paper to draw attention to the occurrence of unilateral displacement of this line, rather than the well recognized bilateral or fusiform shadow.

ANATOMY

Careful anatomical studies by Lachman (6), Garland (5), and Brailsford (1) have demonstrated that on the left this posteromesial line is formed by the mediastinal pleural border of the left lung. In the lower portion of the thorax it lies perpendicular to the central ray on anteroposterior roentgenograms of the thorax. Normally the line lies immediately adjacent to and parallel to the lateral border of the thoracic vertebrae and medial to the shadow of the descending aorta. The aortic shadow, however, may be straight but directed slightly medially as it descends from the aortic knob in younger persons or somewhat convex in its descent in older individuals with increased tortuosity and uncoiling of the descending aorta. Lachman also demonstrated that this postero-medial pleural line sometimes lies perpendicular to the roentgen ray in the upper thorax behind the trachea both on the right and left sides. In the lower right thorax, because of the shelving characteristic of the postero-medial aspect of the lung, due to the presence of the azygos vein, the right postero-

medial pleural line is usually not seen. It may appear to be continuous with the shadow of the psoas muscle below the diaphragm.

This line is not always seen on the routine roentgenograms of the dorsal spine. It is, however, frequently present, especially in adults and particularly in those in the older age groups. In infants and children it is normally difficult to visualize, although it is seen occasionally. It is also seen frequently in anteroposterior roentgenograms of the abdomen in which the lower portion of the thoracic spine is included. On this latter view, it is rather easily confused with the shadow of the descending aorta and may at times be obscured by the aortic shadow.

ROENTGEN FINDINGS

Abscess formation has long been a well recognized finding in tuberculosis of the vertebrae and is most easily demonstrated in the thoracic spine (3, 7). Doub and Badgley describe these abscesses as usually fusiform or globular since the diaphragm acts as a restraining influence on the downward spread of pus. They also state that in cases treated in the recumbent position abscess formation is likely to occur above the spinal lesion rather than below it, because of the effect of posture. Sgalitzer (8) says that in 80 per cent of cases of tuberculosis of the thoracic spine there is evidence of cold abscess. These abscesses are fusiform, with the widest portion at the level of the bone focus. Similar findings are reported by Rigler, Ude, and Hanson (7), who regard the finding of a paravertebral abscess as almost pathognomonic of tuberculosis, although rarely it may also be found in osteomyelitis. Brailsford (2) notes that the normal paravertebral shadows can be displaced in a fusiform

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manner, *i.e.* bilaterally, by many other disease processes. These include neoplasm of a vertebral body with extension or hemorrhage into the paravertebral soft tissues, pyogenic osteomyelitis of the vertebrae, the acute stage of vertebra plana, osteitis deformans, and osteochondritis of the spine in infants and adolescents. The appearance of paravertebral abscess may be simulated by rupture of a dissecting aneurysm, by localized pleural thickening, or by localized empyema.

The case reported here was unusual in that the paravertebral abscess was unilateral, being confined to the left paravertebral area and extending almost the entire length of the thoracic spine.

CASE REPORT

W. McC., a 57-year-old white male, was admitted to the Cincinnati General Hospital on Jan. 3, 1945. His illness began three months previously when he suddenly began to notice continual severe pain arising between the shoulder blades and radiating anteriorly. The pain gradually subsided for about one month and then became progressively worse until the time of admission. There were also progressive weakness and numbness of the lower extremities, and during the week before admission the patient was unable to walk. A cough, productive of some yellow sputum, had been noticed since the onset of the present illness.

On physical examination the patient appeared chronically ill, complaining of pain in the upper back with any type of motion. Examination of the chest showed it to be emphysematous, with a normal percussion note and a few post-tussive râles over the bases. The heart and abdomen were normal. The lower extremities showed a considerable degree of muscular atrophy especially in the feet and lower legs, with slight muscle tenderness. There was muscular weakness of both legs, more pronounced on the left. The patient was able to flex both knees slightly and to move the toes. On moving the legs there was a mass reflex with defecation. There was hypesthesia below T-6 and absence of pain below T-11. At T-4 and T-5 a tender point was present in the mid-line. The upper deep reflexes were normal bilaterally. Abdominal reflexes were unobtainable. The Babinski sign was equivocal bilaterally, occasionally positive on the right. There was sustained ankle clonus bilaterally.

Blood, urine, and stool examinations gave normal findings. Sputum examination was negative for tubercle bacilli. Lumbar puncture two days after admission was traumatic and manometric studies were normal. On the sixteenth hospital day the



Fig. 1. Anteroposterior Bucky roentgenogram of the thoracic spine (Jan. 4, 1945) showing the widened left paraspinal shadow (lower arrow) extending along the entire left side of the spine. The aortic knob and descending aorta lie to the left of this shadow and are of lessened density (upper arrow). There is slight collapse of the body of the fifth thoracic vertebra.

spinal fluid was slightly cloudy and yellow with 6 white cells, 4,980 red cells, Pandy reaction++. On the twenty-fifth hospital day a lumbar puncture showed an initial pressure of 100 with clear slightly yellow fluid, no clot, no cells, Pandy reaction++++. Jugular compression raised the spinal fluid pressure to 175 mm. H₂O with a slow fall to 150 mm. H₂O. Abdominal compression caused a rise to 200 mm. H₂O with a prompt fall to 100 mm. H₂O.

A teleroentgenogram of the chest revealed old pleural thickening on the left lateral chest wall. Miliary nodules were scattered diffusely throughout both lung fields, with superimposed congestive changes. Roentgenograms of the thoracic spine revealed old healed rib fractures of the eighth, ninth, and tenth left ribs in the posterior axillary line. There was collapse of the body of T-5 and narrowing of the adjacent intervertebral spaces. The left paravertebral shadow was definitely widened along the entire thoracic spine. The lower thoracic spine and upper lumbar spine showed marked osteo-arthritis changes, with bony ankylosis involving the ligaments in the dorsolumbar area. The findings were thought to be due to tuberculous spondylitis of T-5 with unilateral left paraspinal abscess and miliary spread to the lungs. Repeat roentgen examination one month after admission showed no changes. (See Figs. 1, 2 and 3.)

Because of the evidence of spinal cord compres-

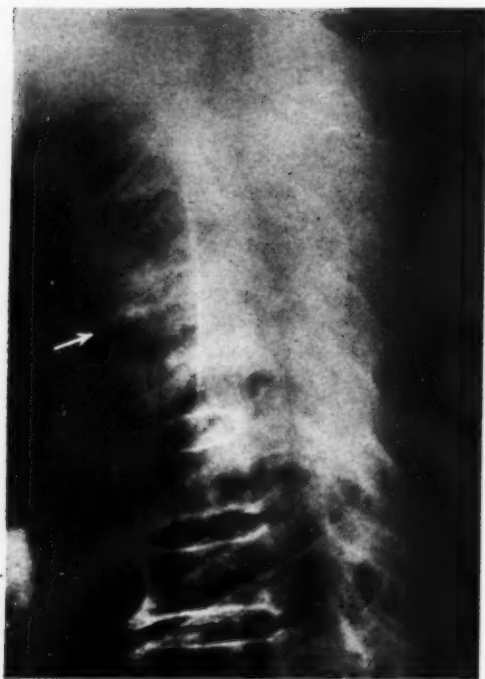


Fig. 2. Lateral roentgenogram of the thoracic spine (Jan. 12, 1945) showing the partial collapse of the fifth thoracic vertebra with narrowing of the interspaces above and below (arrow).

sion, a laminectomy of T-4, 5, and 6 was done on the eleventh hospital day. The operative site was extremely vascular, and in the remaining portion of the laminae and the spinous processes small cystic areas were seen, filled with reddish granulation tissue. The epidural space was explored, but no appreciable granulation tissue was encountered. The dura was somewhat reddened and injected, but there was no definite compression from without. There was, however, a very definite fullness of the cord at the interspace between D-4 and D-5, and at this level there was compression of the cord by the prolapsed fifth lamina. Subsequent microscopic examination of the excised bone taken from the removed laminae showed diffuse miliary tuberculosis. The soft tissue biopsy material showed only small areas of granulation tissue.

Since the spinal cord obstruction was not relieved by the laminectomy, a left costotransversectomy was done on the thirty-sixth hospital day. The sixth rib was resected for a distance of 4 cm. laterally from the costovertebral joint, with removal of the transverse process. The pleura was exposed and retracted away from the under side of the rib cage. This was easily done laterally; but on approaching the mesial portion at about the level of the transverse process, the pleura became densely adherent to the under

portion of the transverse process and vertebral body. The resection at this point was very slow; when it was completed, a fluctuant mass lying anteriorly was exposed and entered with an immediate escape of about 10 c.c. of thin grayish fluid containing tiny white flecks. The opening in the abscess was enlarged, and a moderate amount of frankly caseous material was evacuated with a sucker. Several loculated collections of similar material were found, and at least three distinct pockets were identified. The cavity was lined with thick, grayish, ragged,

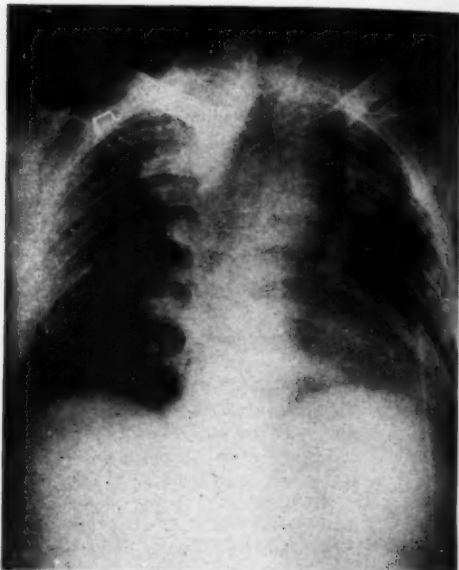


Fig. 3. Postero-anterior teleroentgenogram of the chest (Feb. 8, 1945) showing the miliary infiltrate scattered diffusely throughout both lung fields. The widened paraspinal shadow can be seen behind the cardiac silhouette.

friable granulation tissue. There was erosion of the under surfaces of the adjacent ribs with destruction of the periosteum. Aortic pulsations were well defined.

The postoperative course was gradually downhill, with fever rising daily to 100-101° F. On the sixteenth postoperative day the operative wound broke down and discharged much pus. Multiple decubitus ulcers developed, and the patient became paraplegic. He died in peripheral vascular collapse on the forty-seventh hospital day. No autopsy was performed.

COMMENT

The case described again emphasizes the importance of the linear thoracic paraspinal shadow. Previous published reports have shown that abscess formation is

usually bilateral and fusiform in appearance. As far as can be ascertained, this is the first case reported of unilateral paraspinal abscess. This finding is important both to the surgeon and orthopedist, especially for localization of such effusions for operation and for more accurate diagnosis. In the future it is hoped that smaller effusions will be sought far earlier in tuberculosis of the thoracic spine and also in neoplastic and other inflammatory disease in this location.

SUMMARY

1. The normal anatomy of the linear thoracic paraspinal shadow is reviewed.
2. A case of tuberculosis of the thoracic spine is presented in which the paraspinal abscess was unilateral, presenting only on the left side, instead of being bilateral and fusiform.
3. The recognition of early left unilateral abscess formation, not previously

described, should facilitate the earlier diagnosis of disease of the thoracic spine.

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Observations on Gunshot Fractures of the Mandible¹

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THE PURPOSE of this paper is to analyze from a radiographic point of view over 200 fractures of the mandible, considering mode of demonstration, type and location, associated bone loss, foreign bodies, infection, and facial bone injury. The patients were soldiers, and the vast majority of the fractures were caused by high-velocity projectiles. Very few were of the crush type, so that direct trauma was the exciting cause in almost every instance.

Technic of Demonstration: As in many cases there were associated wounds of the neck muscles, with cumbersome external fixation devices and dressings, positioning for radiography was often difficult for the patient and tedious for the technician. It was therefore necessary to evolve some simple speedy method of securing satisfactory films. The fact that the plastic and dental teams working on these cases felt that the radiography entailed should be taken over by their departments placed an added burden of proof on the x-ray department. After some preliminary studies, the following routine plan was adopted.

The conventional radiographic table with Potter-Bucky diaphragm was placed in the vertical position, and the patient was seated on a stool so that his shoulders were at right angles to the table with one shoulder resting lightly against it (Fig. 1). The patient faced straight ahead so that the sagittal plane of the head was parallel to the table. He then was instructed to incline his head until the parietal eminence also rested lightly against the table. This is a comfortable, easy position to assume, and the angle of inclination thus formed by the tilted head is approximately 30 degrees from the vertical. The chin was held slightly thrust forward, and the mouth kept slightly open, so that teeth were not in contact. The central ray was directed at

right angles to the table and emerged at the level of the first molar of the side being examined. Bucky films were thus obtained in stereo, with the shift in the vertical direction. The patient was then instructed to turn around on the stool and face the opposite direction, when the above procedure was repeated and two more films were

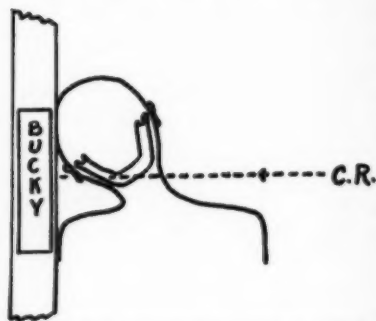


Fig. 1. Position of patient for routine radiography.

taken in stereo. A final set of stereo films was then made with the patient seated on the stool and facing the table squarely, the knees widespread, the chin thrust forward touching the table top, the tip of the nose about one inch away from the table top, the mouth again slightly open if possible. The central ray was directed at right angles to the table and emerged at the upper lip.

This routine examination furnished a right and left lateral and a postero-anterior view, all in stereo. The open-mouth method was found of value in following and separating the contours of the teeth in the maxilla and mandible, as well as the contours of these bones themselves, when the films were placed in the stereoscopic viewing box. The writer is not generally addicted to stereoscopy but is convinced that in studies of this region, where there is so much superimposition, in the presence of variously situated metallic bodies, the advantages of stereoscopic study are well

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worth the additional time and film required.

The routine described may, if necessary, be supplemented with a postero-anterior projection (patient supine) with the neck held in hyperflexion so that the mid-frontal area, about one inch above the hair line, is resting against the table top. This position is particularly good for the demonstration of the temporomandibular joint, the condyles, the condylar neck, and the rami, as well as the zygomatic arch. It is important, when taking this view, that the degree of flexion is such that a vertical line dropped through the mastoid tip comes to lie cephalad to a vertical line dropped through the horizontal plane of the temporomandibular articulation; otherwise the mastoid tip will obscure the joint. In this view of fractures of the condylar neck, the pulling action of the pterygoid muscle upon the upper smaller fragment medially is well demonstrated.

For wider exposure of the cuspid-bicuspid area a film may be taken as described for the lateral view except that the sagittal plane of the skull is rotated 15 or 20 degrees toward the table and the central ray emerges through the bicuspid area. This view serves to "open" the angle between the symphysis menti and the anterior half of the body, thus decreasing the disturbing curve effect in this zone. Intra-oral films were seldom used in this group, although their value in more accurately following the course of confusing fracture lines is unquestioned.

Serial studies are of inestimable value in determining progress, particularly with reference to sequestration and infection, change in alignment of fragments and, later, evidences of union or non-union, as well as the state of progress of bone grafts.

Needless to say, a good working knowledge of the anatomy revealed by the above routine views is essential. The cervical spine, styloid process, hyoid bone, base of the tongue, and the various levels of the air-filled pharynx all offer difficulties to the uninitiated and at times even to the expert. Fracture lines know no law of distribu-

tion, and in no bone is this more true than in the mandible. It is quite necessary, therefore, that the central ray pass squarely through the fracture line if erroneous interpretation is to be avoided. It is not uncommon to see two apparently separate and distinct fracture lines with an island of bone between them. If the upper and lower portions of each line appear to converge, the likelihood of a single fracture must be considered. Here stereoscopy or an intra-oral film is of great help.

General Observations: In this series of gunshot fractures of the mandible, few if any fractures of the condylar neck were encountered. These are more common in civilian life and are usually due to indirect violence, such as a blow on the opposite side of the jaw. The smaller upper fragment is usually displaced medially, but where the condylar head is actually dislocated, a tear of the articular capsule may be inferred. Fracture lines running into a tooth socket should be reported, as the oral surgeon almost invariably insists upon removal of the tooth to avoid subsequent infection incidental to a devitalized tooth. Infection will almost always follow if this crack in the armor is not removed to provide wide open drainage.

Since the majority of fractures in this series were produced by high-velocity missiles, the extent of bone loss was considerable, whole sections of the mandible being literally shot away. Mandibles struck by a partly spent projectile showed considerable comminution and less bone loss.

It is worthy of note that in fractures of the maxilla any displacement is due to the actual force of the blow. Here a displacement or evidence of separation at the suture lines furnishes the clue to the presence of a fracture. In fractures of the mandible, the plane of the fracture line and the direction of the muscle pull on the fragments are two important factors determining the extent of displacement. If the direction of the muscle pull is opposite that of the plane of the fracture line, displacement will be negligible or non-existent. If the direction of pull is along the lines of the fracture plane,

TABLE I: TYPE AND LOCATION OF FRACTURE

Plane and type of fracture	
Vertical.....	12
Oblique.....	24
Horizontal.....	12
Comminuted.....	172
Location	
Symphysis menti (SM).....	56
Anterior body (AB)	
Left.....	92
Right.....	84
Posterior body (PB)	
Left.....	44
Right.....	40
Angle	
Left.....	12
Right.....	18
Ramus	
Left.....	12
Right.....	18

NOTE: Multiplicity of type and location of fractures in any one case accounts for totals in excess of the number of cases in the series. The essential value of this table is merely to indicate the marked frequency of comminuted fractures and to denote the sites of predilection in the group studied.

displacement will be extreme. In the presence of extensive bilateral comminution and loss of bone substance, the ability to manage the movements of the tongue is seriously impaired. Should subsequent films indicate widening of the fracture line, imperfect immobilization or early infection may be suspected.

Avascular dead bone or sequestration is demonstrable later in the mandible than in long bone infections. The mandible apparently does not undergo demineralization so rapidly nor so extensively as do the long bones, so that relative differences in density, usually seen in osteoporotic bone about an avascular bone island, are not readily demonstrable until quite late.

Infection: Osteomyelitis of the mandible was not a common complication in this series. Indeed, the radiographic evidence of infection was extremely low in spite of extensive injury and inevitable mouth infection. Removal of involved teeth, mouth hygiene, and active co-operation on the part of the dentist and the plastic surgeon in the way of planned treatment kept this complication at a minimum.

Non-union of the main fragments is demonstrable by the usual smooth eburnated appearance of the bone edges. With respect to mandible fractures it is axiomatic

that clinical union precedes radiographic union by many months.

Types and Location: Fractures of the mandible due to gunshot wounds, as indicated by this series (Table I), are for the most part comminuted. For the purpose of classification as to location, the mandible is arbitrarily divided, as illustrated in Figure 2. All fractures in the symphysis menti area and laterally up to a vertical line

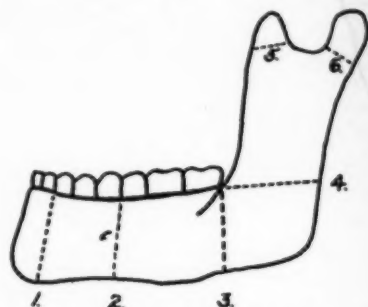


Fig. 2. Arbitrary divisions of the mandible for location of fractures. Fractures to the left of 1 are classified as SM; those between 1 and 2 as AB; those between 2 and 3 as PB; between 3 and 4 as angle fractures; above 4 as rami fractures.

dropped through the lateral borders of the lateral incisors were designated as SM fractures. This includes the area spanned by four teeth, the two central and two lateral incisors. A second vertical line was drawn between the 2d bicuspid and the 1st molar. All fractures between these two lines were called anterior body or AB fractures. A third vertical line was dropped from the retromolar area and all fractures between this and the preceding line were called posterior body or PB fractures. A more or less horizontal line also beginning in the retromolar area and extending posteriorly to emerge at right angles to the inferior ramus was then drawn. All fractures between the last two lines were called angle fractures. Fractures above the last line were rami fractures except for those through the condylar neck and coronoid process, which were so designated. While there is nothing particularly ingenious about this arbitrary division, it is simpler to speak of an AB, an SM, or a PB fracture,

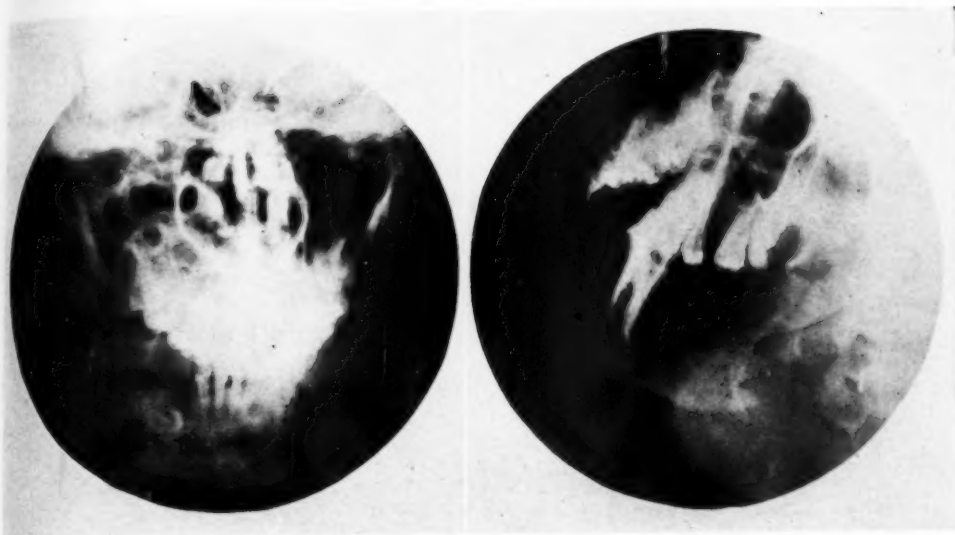


Fig. 3. Multilinear fractures of the right ramus, angle, PB, and AB areas. Loss of osseous substance one plus in angle area. Metallic foreign bodies within and posterior to the angle area.

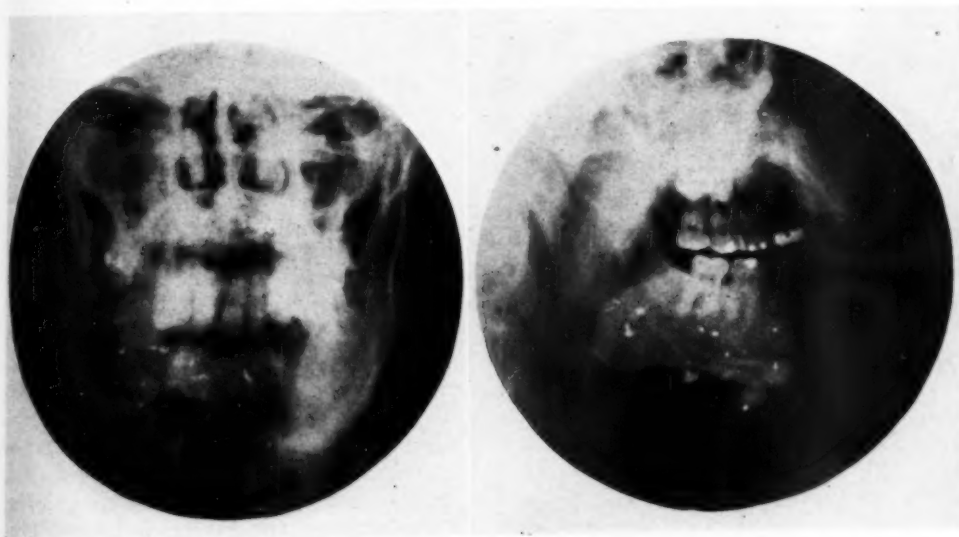


Fig. 4. Complete loss of right half of mandible except for superior segment of ramus. Loss of the AB portion of left side of mandible plus multiple metallic foreign bodies in soft tissues of the right side.

knowing the exact area referred to; the same general division can be made of an edentulous mandible, remembering the position of the mental foramen with reference to the 2d bicuspid. The predominant site for fracture in this series appeared to be the AB area, with the SM area second, and

the PB area third. Angle and rami fractures were last in order of frequency, as noted in Table I.

Bone Loss: The complication of bone loss was a frequent and serious one, prolonging treatment through the necessity of eventual bone grafting. These grafts, incidentally,

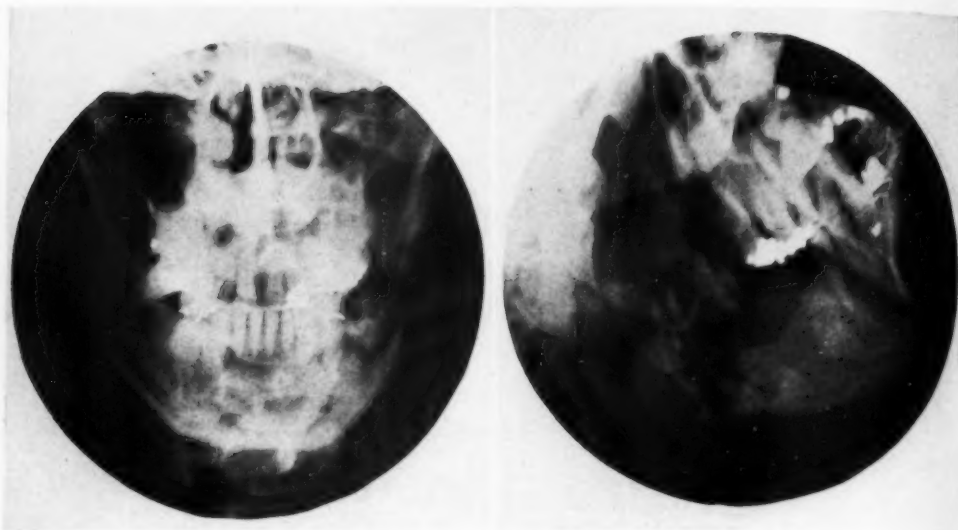


Fig. 5. Extensively comminuted fracture of the angle and ramus with horizontal and vertical fractures in the AB and PB areas. General alignment well preserved in spite of severity of fracture. Bone loss two plus. The hyoid bone is seen running through the angle area.



Fig. 6. Waters-Waldron view of facial bones revealing multiple fractures of left malar bone, its orbital and zygomatic processes, and through the infraorbital ridge. Malar bone *in toto* displaced downwards, disrupting contours of left antrum. Fracture through left AB area.

were usually of the autogenous type (from the crest of the ilium), although a bone bank was available and frequently utilized. Of the 200 cases, 88 showed bone loss incidental to trauma, and in more than half of

these the loss was extensive, being classified as 3 plus and 4 plus. The comminuted fractures of the body were the most common offenders in this respect. Although it was the rule to remove all bone islands or fragments completely separated from the mother bone, some accidentally left behind proved to be adequate foci around which osteoblastic activity later took place and were therefore of help in effecting eventual union.

Foreign Bodies: Metallic foreign bodies were present in 48 cases, or approximately 25 per cent of the total. Originally, this number was undoubtedly higher, for in many of the cases debridement had been done overseas, so that by the time the patients were seen in maxillo-facial and plastic centers in this country only a few residual foreign bodies remained.

Associated Facial Bone Injuries: The association of facial bone injuries with fractures of the mandible was quite frequent; there were 76 such cases in this series. Of the associated injuries, 72 involved the malar bone unilaterally or bilaterally. In 3 cases the zygomatic arch as well as the malar bone was fractured, and

in 1 case there were fractures of the left orbit and the frontal bone (outer plate). Six benign cysts of the mandible were incidental findings.

Conclusions: The above more or less scattered observations with respect to gunshot fractures of the mandible are by no means original. The writer does feel, however, that for adequate visualization of the mandible and facial bones, the method of routine study with supplemental stereoscopy offers distinct advantages over conventional views. This is particularly true where the patient presents extensive neck

injuries rendering positioning difficult. We would like to add the general observation that one cannot take too many views; often an extra film taken in a bizarre position gives valuable information.

In closing, the writer takes the opportunity to express his sincere admiration for the excellent results attained by dental and plastic teams, who not only restored to normal, or passably normal, the faces of these soldiers, but also did much for the restoration of their morale.

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An Addition to the Technic of Simple Breast Roentgenography¹

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ANALYSIS OF THE published work on roentgenography of the breast (excluding artificial contrast methods) prompts us to present our technic, which has helped us to improve the diagnostic quality of our films. A method very like ours is described in Ehrlich's recent paper, of which acknowledgment is made.

1). The posterior axillary line on the affected side is pressed against the cassette holder and the opposite shoulder is swung about 60 or 70° toward the tube so that the breast may be viewed from the tube in full profile, without other tissue superimposed. Thus, the central ray traverses the base of the breast from sternum to mid-axilla in

TABLE I: TECHNIQS OF BREAST ROENTGENOGRAPHY

Author	Ma	Seconds	Distance (in.)	Kv. p.	Other Factors
Carty	100	3.0	36	30-70	Screens
Hunt and Hicken (1939)	50-150				Cardboard
	25-100		30	30-50	Grid and Screens
	10-50				Screens
Gershon-Cohen and Strickler	100	0.3	36	32	Screens
Warren	70	2.5	25	50-60	Screens and Potter Bucky
Seabold	30	1.0	30	...	Screens
Bianchini		2.5	39	40-60	Cardboard
Ritvo, Butler, O'Neill	30	0.5-2	30	30-60	Screens and Potter Bucky
Lockwood	100	0.3-1	36	55-70	Screens and Potter Bucky
Hicken (1937)	37-62 ma sec.		30	76-80	Screens, Cone, 0.25 mm. Al filter
Paschetta	20	0.5	...	60	Screens
Vogel	22	4-6	22-26	43
Ehrlich (upright and pendant)	30	$1/10-1/8$	42	50	Screens
Present authors	120	$1/3$	60	45-55	Screens, 3 inch cone, 0.8 mm. rotating anode

The interpretation of breast films is still a difficult problem, and it may serve a good purpose if we remark here that not only must the technic of making films be the best available, but any supplementary facts pertinent to the case should be sought. A good history and a careful physical appraisal, including transillumination of the breast, will afford none too much assistance in the differentiation between benign and malignant lesions.

1. *Erect, High Breasts* (young, firm type): The patient stands erect against an upright cassette holder such as is used for chest studies. One of two positions may be used:

(A) The oblique anteroposterior (Fig.

the plane of attachment to the thoracic wall. This plane of attachment is a zone of decreased density which it is important to see clearly on films. The nipple in profile at the apex of the breast may be marked with a small spot of barium paste. The patient's hand on the unaffected side draws that breast back out of the field. The arm of the affected side is abducted to 90° or 180° and perhaps rested on top of the cassette holder.

(B) The oblique postero-anterior (Fig. 2). In this posture, the breast will be one to several inches farther from the film than in position "A". The error is a small one, however, and may not be detected. The position is as in "A," but with the unaf-

¹ From the Department of Radiology, Hospital of the University of Pennsylvania, Philadelphia, Penna. Accepted for publication in March 1946.



Fig. 1. Position "A" with bending. Direction of radiation anterior to posterior.



Fig. 2. Position "B" with bending. Direction of radiation posterior to anterior.

affected anterior axillary line against the holder and the affected shoulder drawn back toward the tube.

2. *Pendant Breasts:* For pendant breasts we have found, independently, the method of Ehrlich to be most satisfactory. It is as described above, plus a lateral bending of the patient until the breast hangs free of the thorax (Figs. 1 and 2).

3. *Horizontal Posture for All Breasts:* Most examiners have used the horizontal posture for all cases, placing the patient on a table and the tube above, employing a vertical central ray. This is probably the most inconvenient position for the patient and requires padding of the breast to insure good position. Furthermore, it reduces target-film distance. However, we use it at times in order to spread the breast more flat and thin. It is of greatest value in examination of dense tissue; and is preferable for demonstrating axillary nodes.

At this point we wish to emphasize the advantage of using several exposure factors at one sitting, especially the first. As with other parts of the body, no one film yields complete data. An under-exposed film will give better diagnostic quality to the fatty periphery of the breast and to a

generally fat organ. An over-exposed film will be better for dense tissue.

Initially, a large film, perhaps 7×17 inches, is used to include the axilla. However, the other films may better be 8×10 inches or 10×12 inches, since a cone is to be used if maximum sharpness is desired and economy practised.

We agree with others in advising serial study of a breast and examination of the normal breast for comparison. Also, a record of the stage of the menstrual cycle is necessary, so that this important variant may not give rise to confusion. One examination should be made midway between menstrual periods to secure a resting-stage comparison.

Measurement of the patient has not been used rigidly for estimating exposure factors. Judgment of the size and texture of the breast is probably the best method of controlling a single variable such as kilovoltage. A large fat organ often will require less than a small firm one. The pendant posture demands 3 to 5 kv.p. less than the erect, since the breast grows narrower when hanging. The horizontal position at 46 inches distance requires one-half the time of and 3 to 8 kv.p. less than the erect

at 60 inches. Basic factors for the erect posture are:

Target-film distance.....	60 inches
Screens.....	Par speed double
Cone.....	3 X 12-inch cylinder
Ma.....	120
Seconds.....	$\frac{1}{8}$
Kv.p.....	45 to 55
Anode.....	0.8 mm. rotating

Filter and Potter-Bucky diaphragm are not used.

DISCUSSION

A method of simple roentgenography of the breast is presented which, we believe, is technically improved, complete, and convenient. The erect or erect-pendant posture is used, with added study in the horizontal position when necessary. Very little special equipment is needed (at most a cotton pad). Several exposures of the affected breast are made initially or serially in order to enhance diagnostic accuracy. Since so many breast studies have shown unsharpness and distortion, we advocate a long target-film distance, small cone, smallest possible anode, and an exposure time short enough to eliminate the effect of cardiac or generalized movements.

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Cholecystography: A Comparative Study of Oral and Intravenous Contrast Substances¹

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FOR OVER TWENTY years cholecystography by means of the intravenous administration of sodium tetraiodophenolphthalein has been accepted as the most accurate method of gallbladder examination. One rarely questions the fact that gallbladder function is impaired when that organ cannot be visualized by this means. As Moore (9) points out, intravenous cholecystography is superior in that a known quantity of dye is given under known conditions.

It seems plausible that evaluation of studies with an oral contrast substance by comparison with intravenous cholecystography would be of more value than an appraisal based solely on pathological confirmation. This is true because factors unconcerned with cholecystography enter into selection of patients for surgery. In any group of persons with poorly functioning gallbladders, as determined by cholecystography, only a portion will be clinically suitable for surgical treatment. It may be assumed that most errors will be in the group not operated upon. Such errors will appear in no table of statistics based upon pathological confirmation. On the other hand, evaluation on the basis of clinical diagnosis alone is subjective and is of questionable value.

A new drug known commercially as Priodax (beta - [3, 5 - diiodo - 4 - hydroxyphenyl] alpha phenyl propionic acid) has been introduced as an oral contrast substance for gallbladder visualization. Priodax has achieved prompt and apparently widespread acceptance, and numerous reports (1, 4, 5, 6, 8, 10, 11, 14, 15, 16) have confirmed its superiority to sodium tetraiodophenolphthalein administered orally. The following advantages have been re-

ported: (1) the incidence and severity of vomiting, diarrhea, and other side effects is decreased; (2) the shadow-producing qualities are better; (3) confusing shadows due to contrast medium in the colon are decreased.

The object of this study is to compare examination with Priodax and intravenous cholecystography, where each has been used in the same patient. Particular attention will be paid to discrepancies in the results, and a probable cause for such discrepancies will be discussed.

TECHNICS EMPLOYED

Whatever contrast medium is used, meticulous roentgen technic is imperative. Careful positioning of the patient is essential. The films must be of uniform quality and without movement. The radiographic equipment should be capable of allowing a very short exposure.

Proper preparation for the oral test is important; the influence of a preliminary diet will be discussed later. Six Priodax tablets (0.5 gm. each) are swallowed whole during the course of a fat-free evening meal. The patient may drink water during the evening but is allowed nothing by mouth after midnight. He reports to the x-ray department the next morning, fasting, and at fifteen hours the first film is exposed. The radiologist sees the film, interviews the patient, and outlines subsequent procedures. Films in various positions, at a later hour, or after a fatty meal, may be requested. Since the patient is fasting, a barium meal study may be started without delay if further gallbladder examination is not necessary.

Sodium tetraiodophenolphthalein is administered intravenously under the direct

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supervision of the radiologist; 3.5 gm. of the drug, dissolved and properly filtered and sterilized, is diluted in 500 c.c. of normal saline and injected during a period of approximately forty-five minutes. The dilution and rate of injection are of prime importance. Serious reactions are rare when these principles are observed, whereas they are common if the drug is not diluted or is given rapidly. Films are commonly exposed at four, eight, and twenty-four hours.

DATA

In 1944, 150 patients were examined with Priodax. One hundred and four examinations resulted in normal gallbladder shadows and are not given further consideration in this study. The other 46 patients have also been examined with intravenous sodium tetraiodophenolphthalein. In 39 instances the two examinations were in perfect accord, while in 7 cases there was definite disagreement.

Similar Results: The gallbladder was not visualized by either method in 22 patients. Of these, 13 have undergone cholecystectomy with pathological confirmation of gallbladder disease in all. Twelve of the 13 had multiple calculi, only 4 of which were radiopaque.

In 11 additional patients, faint gallbladder shadows were produced by each method; 5 had filling defects typical of calculi. Seven of these patients have been operated upon, again with definite pathological confirmation of the roentgen findings (4 with calculi, 3 without).

Six more cases showed fairly good concentration by the oral method. While the density of the shadow was somewhat increased by the intravenous method in all of these cases, they probably should have been considered normal on the basis of the oral examination alone, and are not discussed here.

Dissimilar Results: In 7 cases the two examinations were in definite disagreement. The Priodax shadows were faint, indicating poor concentration of the dye; the faintness of the shadow, if obtained by

intravenous cholecystography, would be considered a definite indication of gallbladder disease. Yet when these 7 cases were re-examined by the intravenous method, fairly good to normal density of the gallbladder shadow resulted. Details of several of these cases will be presented.

Reactions: Reactions were recorded only when the patient felt they were definitely due to the drug. The approximate incidence with Priodax was: nausea 13 per cent, headache 11 per cent, diarrhea 11 per cent, dysuria 4 per cent, and vomiting 2 per cent. It is of special interest to note that neither vomiting nor diarrhea interfered with absorption of the drug; all such patients exhibited satisfactory concentration of the dye.

CASE REPORTS

CASE I. M. M., a white female aged forty-three, had suffered several attacks of right upper quadrant and general abdominal pain, chiefly cramping in character, associated with nausea, vomiting, and diarrhea. Following one such episode, cholecystography was done. The vomiting and diarrhea had ceased, but the patient had had nothing but a liquid fat-free diet for several days preceding the examination. Oral cholecystography with Priodax resulted in very faint shadows. Re-examination was done by the intravenous method; at four hours the shadow was somewhat denser than with Priodax, while at eight hours it approached normal density. The roentgen diagnosis was decreased function of the gallbladder, probably secondary to the general condition of the patient.

A gastro-intestinal study was essentially normal, and the final diagnosis was food allergy. Five weeks later, after the patient had been on a normal diet so far as fats were concerned; the Priodax examination was repeated and the gallbladder shadow was of normal density.

CASE II. A. R., a white male aged forty, had been on a completely fat-free diet for suspected chronic cholecystitis. Because of recent gastro-intestinal symptoms, he had had only liquids just prior to examination. The results with both Priodax and intravenous cholecystography were identical with those in Case I. Three weeks later, after the patient had been on a normal diet, Priodax examination was repeated and normal gallbladder shadows were obtained.

CASE III. B. L., an obese female aged twenty-one, presented vague gastro-intestinal symptoms. She was on a liquid diet several days prior to examination. Faint visualization of the gallbladder was obtained with Priodax, whereas the intravenous

method produced a gallbladder shadow of normal density.

Four additional cases are similar in nature. The patients were examined after being on a greatly restricted diet. Priodax cholecystography resulted in faint shadows, whereas the intravenous method produced good to normal visualization of the gallbladder.

DISCUSSION

Only those cases in which Priodax cholecystography indicated gallbladder disease will be discussed. These cases may be divided into two groups. In 22 cases the gallbladder was not visualized, and in 18 cases the density of the gallbladder shadow was distinctly less than normal.

Of the 22 cases not visualized with Priodax, none was visualized by the intravenous method. This is strong evidence that Priodax cholecystography is trustworthy when the diagnosis of gallbladder disease is based on non-visualization.

When the gallbladder was faintly visualized, however, the diagnosis was not dependable. Eleven of the 18 cases were confirmed by the intravenous method, whereas 7 showed normal concentration when the examination was repeated with the intravenous dye. Since these cases comprised 12 per cent of the entire series, critical evaluation of the contrast substance should depend on a study of such cases.

If Priodax cholecystography is to achieve accuracy comparable to that of the intravenous method, the problem of evaluating the faint shadow must be solved. The faint shadow cannot be considered normal, for in 7 cases of this series it was proved microscopically to be due to significant organic disease. In other cases these faint shadows obviously did *not* indicate organic gallbladder disease.

When 12 per cent of the results are questionable, the value of the examination is limited. It is not sufficient to state that diagnosis must depend also on clinical findings; we all accept the dictum that cholecystography is not a test for cholecystectomy. The real problem is to eliminate, or

at least recognize, those cases in which a faint gallbladder shadow is not significant.

The Faint Shadow: The diagnosis of gallbladder disease based on faintness of the shadow is an established procedure when the intravenous method is used. In this series, 7 such cases were operated on and the opinion confirmed, and 2 more are presumably confirmed by the roentgen demonstration of biliary calculi.

Scott and Moore (13) summarized the findings in 1,355 intravenous cholecystograms. In 12.9 per cent of this number gallbladder disease was diagnosed because of faintness of the shadow. It was felt that this diagnosis was of definite clinical value. A comparison of operative findings and pathological reports revealed an accuracy of 92.7 per cent. No mention is made of preliminary diet.

Scott and Moore point out that such diagnosis hinges largely on the ability and experience of the roentgenologist, and that the personal equation comes into play. The physician must be familiar with changes resulting from improper roentgen exposure and from variations in the thickness of the patient. They point out that the success of a diagnosis based on the degree of impaired function demands that a constant and known quantity of the medium reach the blood stream, and this can be achieved only by the intravenous method. Otherwise, it is impossible to compare the density of one gallbladder shadow with another. They have no confidence in the radiologic diagnosis of gallbladder disease because of faintness of the shadow obtained by oral cholecystography, since the amount and rate of absorption of the dye from the alimentary canal are unknown.

Influence of the Preliminary Diet: The 7 cases in which there was a pronounced discrepancy between Priodax and intravenous cholecystography have one common factor. In each, the patient had eaten no fat food, or no food at all, prior to examination. It is probable that the gallbladder was full of thick concentrated bile, so that fresh dye-laden bile could not be admitted.

The limitations of cholecystography in

the presence of certain extrabiliary organic disease are well known and always stressed. It seems logical that physiological conditions could interfere equally with the function of the organ. Is it not certain that a fat-free diet—so often advised in cholecystitis—will result in stagnation and almost complete cessation of function? The patient who is on a fat-free diet, and even more so the patient who has taken no food at all, probably has a gallbladder full of thick concentrated bile. Into such a gallbladder the fresh dye-laden bile cannot enter in normal quantity; most of the fresh bile passes on into the duodenum.

This is not a new concept. Curl's (2, 3) studies on supposedly normal medical students offer convincing evidence that the preliminary diet influences gallbladder function as portrayed by oral cholecystography. His experiments indicate that a fat diet preceding cholecystography will give more accurate results.

In 1935 Jenkinson (7) advocated that all patients with non-visualization be re-examined after a month, during which time a diet rich in fats should be given. In a case of non-visualization by the intravenous method in which cholecystectomy was performed, Whitaker (17) found, a normal gallbladder filled with thick concentrated bile. Robinson (12) recommends the routine administration of a fat meal three hours prior to ingestion of the oral dye.

Nevertheless, such a procedure has not been widely accepted or emphasized. Of the papers on Priodax so far published, only those by Vaughan and Eichwald (15) and by Unfug (14) suggest a fat meal prior to examination. Usually the subject is dismissed with the statement that regular diet is allowed until the drug is administered.

It appears that the preliminary diet affects oral cholecystography more than it does intravenous cholecystography. This is logical, since concentration of dye in the hepatic bile is probably higher, over a shorter period, with the intravenous method. Even so, gallbladder stasis incident to a fat-free diet may affect intravenous chole-

cystography, resulting in delayed and decreased function as judged by shadow density. It is logical to assume that accuracy of diagnosis based on faintness of the shadow obtained by intravenous cholecystography might be improved were the examination preceded by a high-fat diet.

Further studies in evaluation of the faint gallbladder shadow as found in Priodax cholecystography are necessary. It is in this group of cases that the accuracy of oral cholecystography can be improved. This study suggests: (1) that faint shadow not due to organic gallbladder disease will be less frequent if a fat meal prior to examination is routine; (2) in the evaluation of a faint shadow in any particular case, the preliminary diet of the patient should be considered; (3) that, if the diagnosis is in doubt, re-examination after a period of fat diet, or with intravenous dye, is desirable.

SUMMARY

The advantages of Priodax over oral sodium tetraiodophenolphthalein are confirmed in a series of 150 examinations.

Forty patients in whom Priodax cholecystography indicated decreased function were also examined with intravenous sodium tetraiodophenolphthalein.

The Priodax findings were confirmed in 33 cases, and of these 20 were further confirmed by pathological study.

In 22 cases the gallbladder was not visualized either by Priodax or by intravenous sodium tetraiodophenolphthalein. The gallbladder was faintly visualized by Priodax in 18 instances, but in only 11 of these cases was a similar result obtained by the intravenous examination.

Seven cases which were poorly visualized with Priodax showed normal concentration when re-examined by the intravenous method. The common factor in these 7 cases was the absence of fat in the diet for several days preceding examination.

This study emphasizes the importance of a high-fat diet to empty the gallbladder prior to examination. It appears that the adoption of such a routine would eliminate

one of the largest sources of error in oral cholecystography.

CONCLUSIONS

1. Priodax is a satisfactory oral drug for contrast visualization of the gallbladder.
2. Non-visualization of the gallbladder after administration of Priodax is dependable evidence of organic gallbladder disease.
3. Faint, subnormal density of the gallbladder shadow may be due to organic pathology or may be secondary to physiological stasis of the gallbladder.
4. A high-fat diet prior to cholecystography will increase the accuracy of the examination.

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Late Changes in Mucous Membrane of the Irradiated Larynx

Their Radiobiological Relationship to the Subepithelial Connective Tissue and to Retrogression of Laryngeal Carcinoma: Histologic Studies¹

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COUTARD (1922) was the first to describe the early fibrinous reaction to irradiation of the mucous membrane (radioepithelitis) of the oral cavity, larynx, and pharynx. He observed that the difference in radiosensitivity of the epithelium and the epidermis is about the same when protract-

selective destruction of the basal cells of the mucous membrane, the so-called epithelicide dose, is about 3,500 r, and the same effect on the epidermis is attained by about 4,500 r.

I had the opportunity of studying microscopically the mucous membranes of the

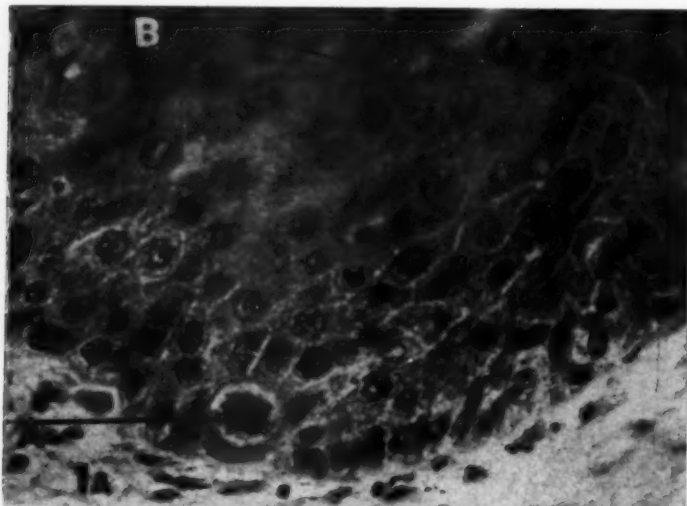


Fig. 1A. Epidermoid metaplasia of mucous membrane of larynx after irradiation. Note well developed prickly cells. Pathological mitosis in basal-cell layer (A); beginning cornification (B). Hematoxylin eosin. $\times 700$.

tion and fractionation are employed as when other methods of irradiation are used. The epithelium of the larynx is destroyed in approximately thirteen to eighteen days. The epidermis of the neck, however, does not disintegrate before the twenty-sixth to the twenty-eighth day. The mucous membrane has regenerated approximately twenty-six days after the first irradiation; the epidermis after forty-two days. The physical dose necessary for

irradiated human larynx specimens one to ten months after protracted fractionated irradiation for carcinoma. The average tissue dose was 5,800 r. The Thoraeus filter had been used, with 220 kv. and an average rate of 8.1 r/min. The size of the fields was 6×6 cm. Only one of the larynges was still in the stage of fibrinous reaction. All the others were in later stages. This observation has been described in an earlier paper in this series. It revealed de-

¹ From the Department of Radiology, Stanford University School of Medicine, San Francisco, Calif. The third of a series of four papers accepted for publication in June 1946.

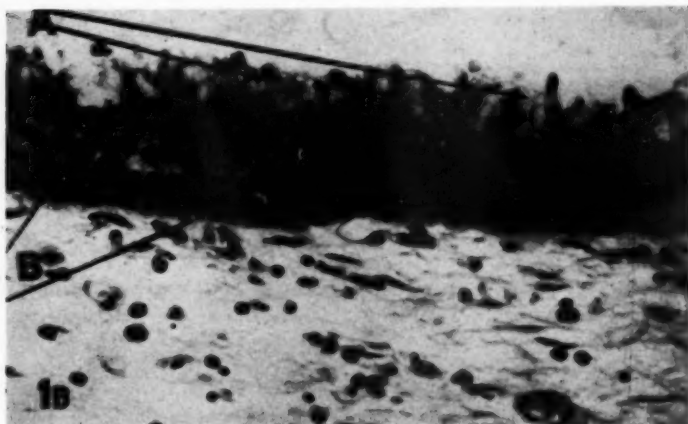


Fig. 1B. Beginning squamous metaplasia of columnar cells (A); squamous cells (B). Hematoxylin eosin. $\times 500$.

struction of the epithelium at this stage.

Microscopic examination about one month after completion of the course of irradiation shows regeneration of the epithelium; the familiar normal structure of the mucous membrane of the larynx is never exhibited. It is transformed into a highly differentiated, epidermoid epithelium showing various degrees of cornification. The basal-cell layer is often somewhat irregular and contains a few normal and occasional pathological mitoses (Fig. 1A). These changes are observed not only in places where, under physiological conditions, the larynx is covered with squamous epithelium (epiglottis, anterior portion of the arytenoid cartilage, vocal cords), but also in those areas in which normally high columnar ciliated epithelium is usually found (Fig. 1B). The transformation of the simple squamous epithelium of the larynx into highly differentiated, cornifying, epidermoidal structures develops, therefore, as an indirect metaplasia following disintegration of the original epithelium.

Experimental studies on the irradiated larynx of the guinea-pig likewise reveal epidermoid metaplasia of the epithelium and of the ducts of the laryngeal glands (5,000 r tissue dose by fractionated protracted irradiation during a four-week period) (Fig. 2).

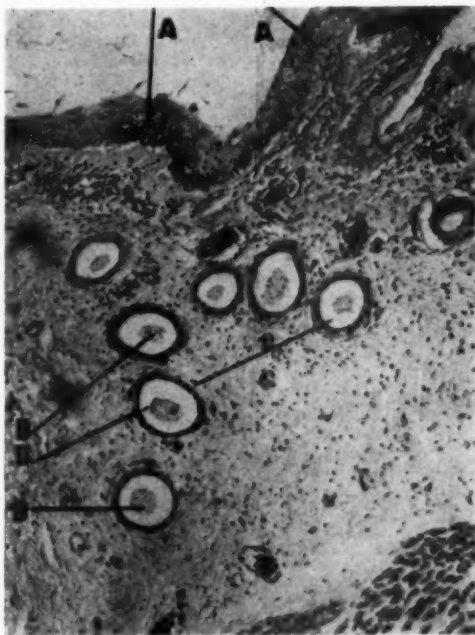


Fig. 2. Larynx of guinea-pig after x-ray irradiation. Squamous metaplasia of epithelium (A) and of dilated ducts of laryngeal glands (B). Hematoxylin eosin. $\times 185$.

The thickness of the metaplastic epithelium of the larynx, which varies somewhat in normal conditions, differs widely after irradiation. The prickle-cell layer in the writer's cases was formed mostly by three to four or more layers of increasingly corni-

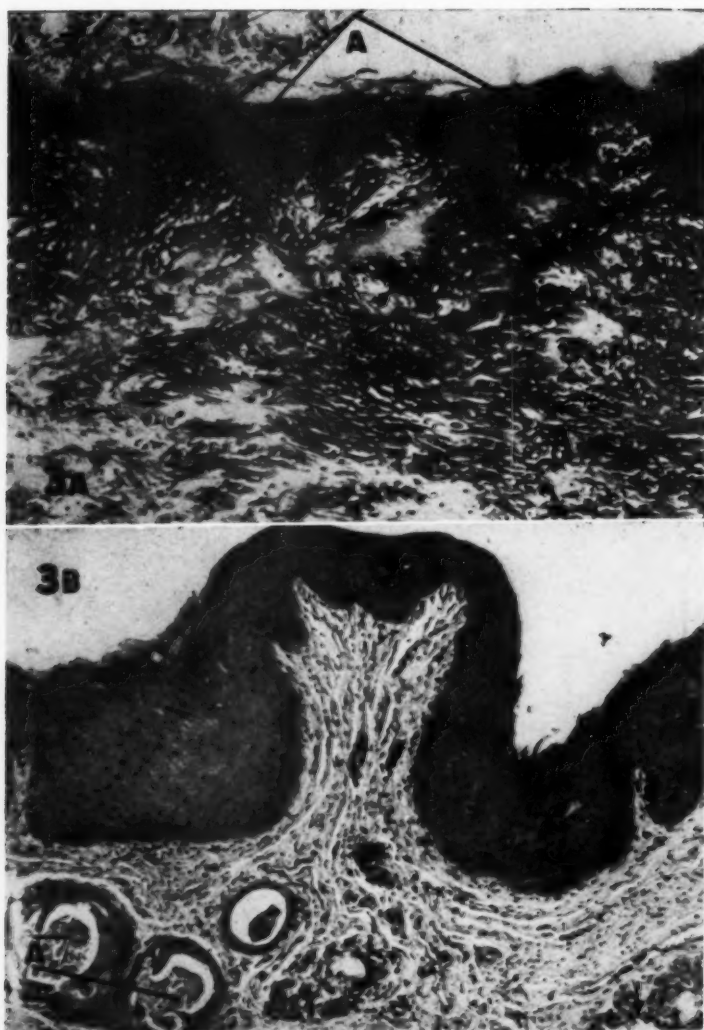


Fig. 3. A. Advanced atrophy of epithelium associated with hyaline sclerosis of subepithelial connective tissue. Note large amount of collagenous intercellular fibers and very few nuclei. Keratin masses (A) and few epithelial cells above connective tissue. Hematoxylin eosin. $\times 250$.

B. Thick epidermoid epithelium growing above well preserved connective tissue. Note squamous metaplasia of columnar epithelium of glandular ducts (A). Hematoxylin eosin. $\times 250$.

fied cells. In areas in which the subepithelial connective tissue shows advanced post-irradiation retrogressive changes (hyaline or fibrinoid degeneration, scar formation), the epithelium becomes regularly thin (two to three layers). In general, the layers of prickle cells are reduced in such conditions. Sometimes, a single layer of

basal cells and a meshwork of cornified material without cells are visible above the hyaline connective tissue. In cases receiving a large tissue dose (7,170 r) and presenting advanced hyaline degeneration of the subepithelial connective tissue, this atrophy of the epithelium is especially marked (Fig. 3A).

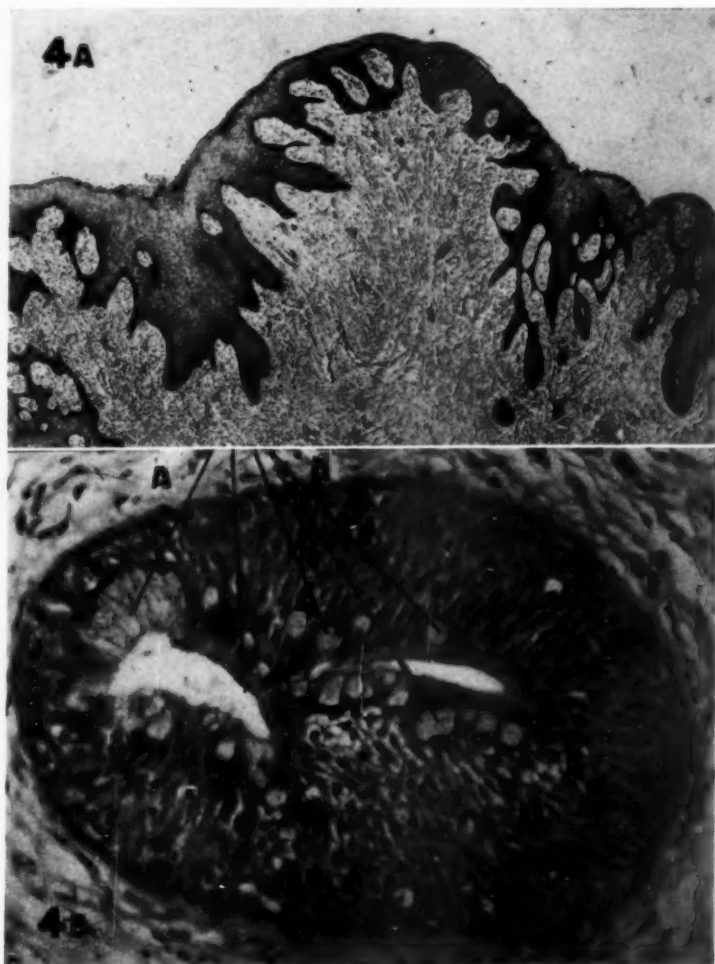


Fig. 4. A. Deep epithelial papillae are proliferating into well preserved connective tissue. Precancerous structure of laryngeal epithelium. No signs of malignancy. Hematoxylin eosin. $\times 150$.

B. Squamous epithelial structures growing into ducts of laryngeal glands. Well-preserved columnar epithelial cells (A) above growing epithelial masses. Hematoxylin eosin. $\times 500$.

Hyaline sclerosis of the connective tissue is almost regularly present in cases in which the fibrin reaction is strong, appears early, and is maintained for a long period of time. In cases in which no fibrin membrane is observed or the reaction is weak, these sclerotic changes are less marked or absent. In such conditions, the epithelium is thick and the cornification negligible (Fig. 3B).

Further studies of the metaplastic

squamous epithelium several months after irradiation show various changes within the epithelium, sometimes morbid, sometimes apparently physiological. Marginal ingrowth of metaplastic squamous epithelium to cover ulcerated areas, I have regarded as physiological. I have considered as pathological, variations in thickness of the epithelium, regressive and progressive changes of epithelial cells, and abnormal mitoses in the germinative layer.

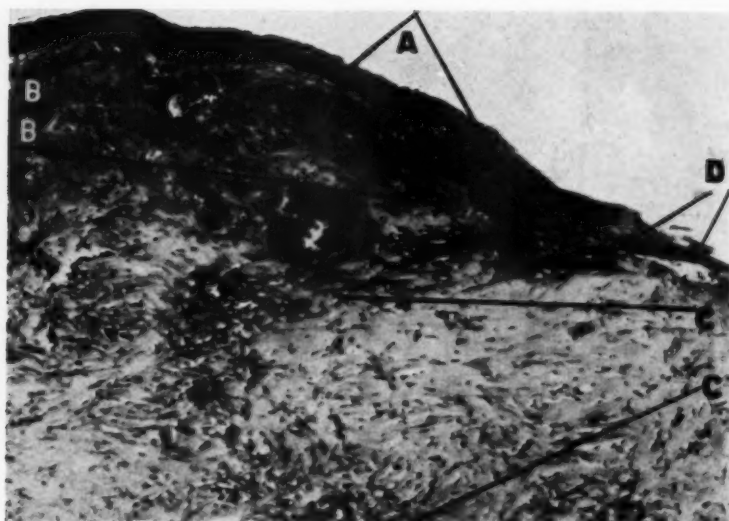


Fig. 5. Thin epithelium (A) above fibrinoid connective tissue (B), becoming increasingly atrophic (D), covering hyaline sclerotic tissue (C). Hematoxylin eosin. $\times 250$.

In two cases in which recurrence of the tumor was found (tissue doses 5,380 and 4,350 r; examination five and seven months after irradiation), the epithelium was very thick, revealing deep papillae and growth of squamous structures into the ducts of the laryngeal glands (Fig. 4). Giant nuclei and multinucleated cells were seen in the deep parts of the epithelium. The microscopic appearance was similar to that in known precancerous states of epithelial structures.

Most remarkable is the regular coincidence of atrophy of the epithelium with hyaline sclerotic changes in the connective tissue. This is associated with considerable thinning of the connective-tissue layers and condensation of elastic fibers. If, in the same specimen, atrophic areas of connective tissue alternate with well preserved structures, atrophy of the epithelium is found to be more or less limited to the former (Fig. 5).²

In two cases in which the epithelium was thin and the connective tissue atrophic,

sclerotic, with frequent areas of hyaline degeneration and obliterated blood vessels, as in scar tissue, the tumor disappeared clinically as well as microscopically. In the other cases, the epithelium was usually thick and no hyaline scar tissue was present, while the connective tissue was for the most part well preserved, or regenerated, exhibiting no sign of radiation changes. In these cases, residual or recurrent tumors have been observed.

It seems that the coincidence of atrophy of the epithelium and hyaline sclerosis of the connective tissue is not fortuitous. Both changes are directly or indirectly induced by the same biological factors. A causal connection between progressive atrophy of metaplastic mucous membrane and hyaline sclerosis of connective tissue is acceptable on the basis of microscopic findings.

These findings may be corroborated by observation of the behavior of the columnar epithelium of laryngeal glands after irradiation. These often exhibit squamous metaplasia of the epithelial linings and dilatation of the ducts. In the presence of hyaline sclerosis of the connective tissue around the glands, the metaplasia may ex-

² In this connection, it seems worth while mentioning that atrophy of the connective tissue of the skin, regardless of the cause, is also always followed by atrophy of the epidermis. On the other hand, primary atrophy of the epidermis is unknown.

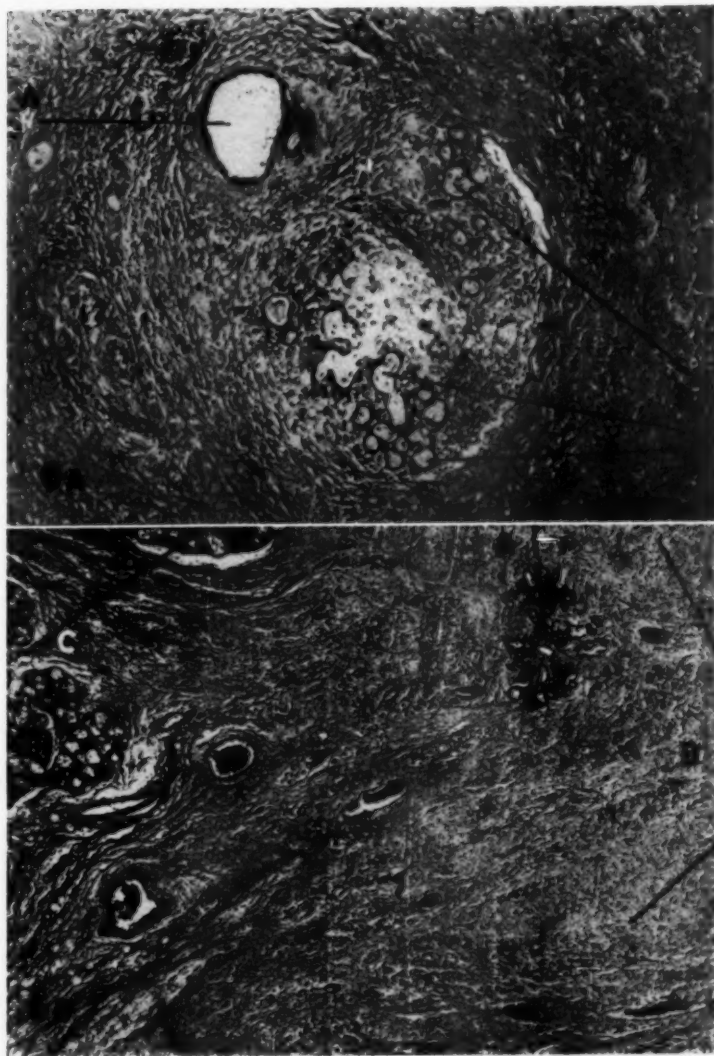


Fig. 6. A. Atrophy of laryngeal gland following irradiation. Dilated duct (A) and dilated alveoli (B) are partly outlined by metaplastic squamous epithelium. Note mucous degeneration of connective tissue and mild cellular infiltration. Hematoxylin eosin. $\times 70$.

B. Advanced atrophy of laryngeal glands (A) surrounded by hyaline sclerotic connective tissue (B). Note well preserved glands imbedded in normal appearing connective tissue (C). Hematoxylin eosin. $\times 50$.

tend from the ducts into the alveoli. Subsequently the glands may become wholly atrophic.

Occasionally the sclerosis of the connective tissue involves more or less circumscribed areas below the epithelium. In such cases it may be observed that those

glands which are inside the sclerotic area are atrophic while those which are outside of it, and surrounded by well preserved connective tissue, show a nearly normal structure, despite the fact that they have been exposed to the same dose of radiation (Figs. 6A and 6B).

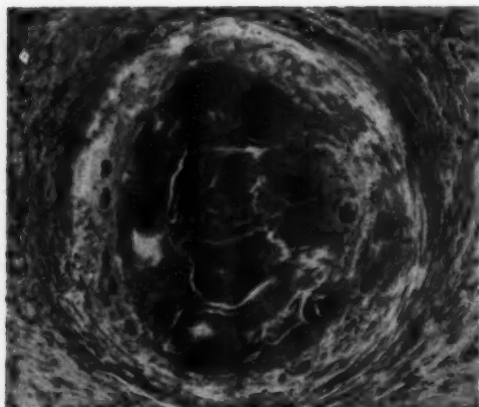


Fig. 7A. Amorphous keratin masses indicating non-viable residues of squamous-cell cancer surrounded by hyaline sclerotic connective tissue. Hematoxylin eosin. $\times 180$.

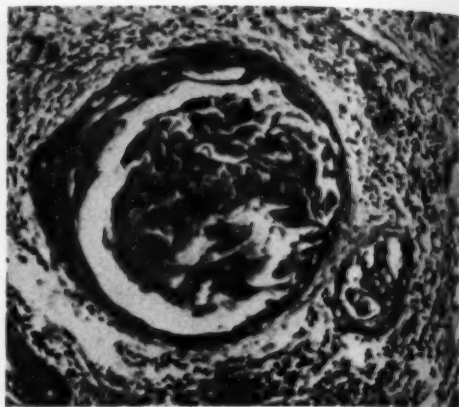


Fig. 7B. Residues of squamous-cell cancer with viable tumor cells surrounded by slightly infiltrated but not hyaline sclerotic connective tissue. Hematoxylin eosin. $\times 180$.

If this relationship is transferred to the tumor and its connective surroundings, we may state that the same conditions which are instrumental in producing atrophy of the epithelium may also cause atrophy and final disappearance of epithelial tumor tissues (Figs. 7A and 7B). The interaction

between sclerosis of connective tissue and atrophy of the epithelium has already been anticipated by Coutard and by later investigators. So far as I know, however, it never has been conclusively proved and demonstrated as it appears in the present series of examinations.

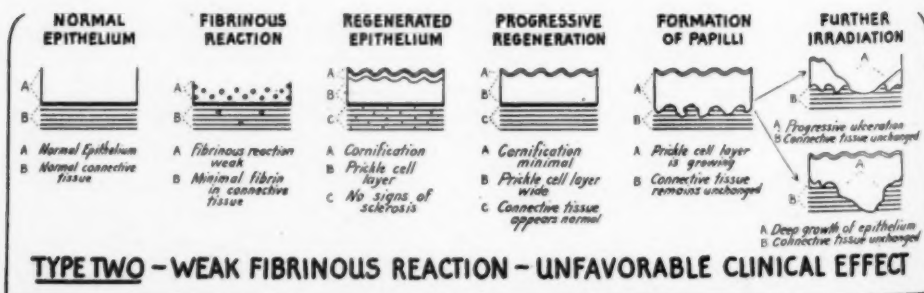
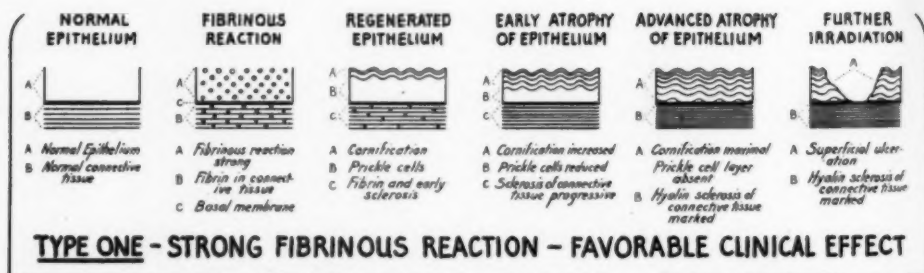


Chart 1. Types of fibrinous reaction and their clinical effect.

SUMMARY

Microscopic study of the mucous membrane of the cancerous larynx after protracted fractionated irradiation reveals that the primary effect of irradiation is cell destruction. At the time fibrinous reaction occurs, the mucous membrane is entirely destroyed. Later, regeneration of epithelium takes place. The regenerated epithelial structures which often replace the columnar epithelium are also metaplastic, revealing excessive cornification. This metaplasia has also been produced by irradiation in animal experiments.

The structure of the regenerated epithelium varies according to the post-irradiation condition of the subepithelial connective tissue. In two cases out of ten the subepithelial connective tissue of the larynx was transformed into hyaline sclerotic tissue with large amounts of interstitial collagen, few cells, and obliteration of blood vessels. In these two cases, the epithelium was markedly atrophic and the tumor of the larynx had disappeared. Clinically, strong fibrin reaction was ob-

served. In two other cases displaying large residual or recurrent tumors, the superficial epithelium exhibited definite tendencies toward atypical growth after irradiation. The connective tissues were remarkably well preserved in these cases and clinically no fibrin reaction was observed.

These studies indicate that, while the primary epithelical radiation effects are fading out, the changing generations of metaplastic epithelium adapt the growth and differentiation properties of their structures to the post-irradiation condition of the subepithelial connective tissue. In cases in which the tumor has disappeared, advanced diffuse atrophy (fibrosclerosis) of the connective tissue and epithelium is observed.

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Legal Liability For Error in Diagnosis

Roentgenologist and His Employer Held Liable for a Mistaken Diagnosis¹

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"Agency is always a question of fact for the jury".

A VERDICT AGAINST a chiropractor-roentgenologist and his employer recently affirmed by the Appellate Court in California cannot but be of great interest to all radiologists.

The plaintiff, after injuring his back, was taken to the Los Angeles College of Chiropractic. After a physical examination by a chiropractor, he was informed that he had sustained a bad sprain and should have a roentgenographic examination. In an adjoining room, for \$15.00, an anteroposterior film of the lower dorsal and lumbar spine was made by another chiropractor, who declared: "Well, this confirms the doctor's diagnosis. There are no bones broken."

The patient then returned to his home and, after being in bed for three days and suffering intense pain, was taken to the Los Angeles Hospital, where anteroposterior and lateral roentgenograms showed a compression fracture of the twelfth dorsal (thoracic) vertebral body.

Later, this patient brought suit against the Los Angeles College of Chiropractic and the chiropractor-radiologist and secured a judgment. From this verdict and judgment the defendants appealed to the District Court of Appeals of the Second District, Division 1 of California. In the trial, the college contended that the radiologist operating the roentgen laboratory was neither its agent nor employee at the time of the plaintiff's examination. From the evidence, however, it was shown that the x-ray department was in one of three rooms, next to the waiting room, on the ground floor of the college building, and that the x-ray apparatus was owned by the president of the college. The radiologist did the examinations for the president's

patients and taught a course in x-ray diagnosis in payment for rent, telephone, and janitor service. He collected his own fees from all other patients and conducted the x-ray laboratory as though it were his own.

The Appellate Court said: "Before a recovery can be had against a principal for the alleged act of an ostensible agent, it must be shown that the third person, dealing with the agent, did so with a reasonable belief in the agent's authority, that the belief was generated by some act or neglect of the principal sought to be charged, and that the third person in relying on the agent's apparent authority, was not guilty of any negligence on his own behalf. So far as the record shows, the college did nothing to put the plaintiff on notice that the x-ray laboratory was not an integral part of the institution, and it cannot be seriously contended that the plaintiff, when he was being carried from room to room, suffering excruciating pain, should have inquired whether the individual doctors who examined him were employees of the college or were independent contractors. Agency is always a question of fact for the jury, and the trial court held that the evidence in the case was sufficient to support the jury's implied finding that J—(the radiographer) was the ostensible agent of the college.

"The college also contended that there could be no recovery against an x-ray technician unless two facts were established: negligence on the part of the technician and evidence that the pictures (*sic*) were used by the physicians in treating the plaintiff or as a diagnostic aid. The record reveals that J—(the radiologist) did not follow the generally accepted practice of

¹ Accepted for publication in June 1946.

taking a lateral as well as an antero-posterior x-ray, whenever an injury of the spine is indicated. Furthermore, he developed and read the roentgenograms immediately after he took them and made the positive statement: 'Well this confirms the doctor's diagnosis. There are no bones broken.' It must therefore be assumed that the pictures were taken as a diagnostic aid and that if J— had discovered that the patient's back was broken, he would have known that fact so that further attention could have been given to the injury."

The Appellate Court concluded, therefore, that the "evidence produced at the trial amply supported the jury's verdict that J— was negligent and that such negligence was the proximate cause of damages

to the plaintiff." The judgment in favor of the plaintiff was affirmed.

The foregoing case (*Stanhope vs Los Angeles College of Chiropractic*, 128 Pac. R. 2d, 705) contains several important references to the duties of radiologists and physicians, in addition to the "agency" reference. The holding of physicians liable for mistaken diagnoses is a rare and unusual instance and is an indication that we who are making diagnoses must be more than ever careful to guard against mistakes. As a matter of fact, it is exceedingly doubtful if a court of last resort in any other state would be liable to render a verdict or uphold one that was based upon an error in diagnosis.

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EDITORIAL

Radiology and the Future

Presidential Address, Thirty-Second Annual Meeting
Radiological Society of North America¹

LORD BACON remarked that every man owes to the profession which nourished him some portion of his time and effort, and I suppose he meant to include in that statement the advisability of thinking sometime about one's profession. As one does so, there come to mind thoughts which concern the future of our specialty and raise questions which must have occurred to most of you many times.

What does the future hold for Radiology? Shall it continue as a free specialty, increasing in rank and dignity, or shall it be absorbed gradually into the multiple specialties to which it contributes? Shall it remain a recognized branch of the practice of medicine or shall it become submerged in the general functions of hospitals? Shall it continue to be taught as a specialty, or shall its teaching in the future be directed to those many specialists who will use it within their own fields? On the answers to these cogent questions rests the future of Radiology, and perhaps even the level of our national health, since it may well be that if medicine is deprived of the extraordinary co-ordinating skill possessed by the modern radiologist, diagnostic ability as a whole may reflect the ensuing loss.

The future is a malleable thing. It is not rigid, nor is it preformed or predetermined. It is shaped by the will of men, and its form is being determined now, by us, and by many others. We have not the entire shaping of it, however; its character may be altered by influences beyond our immediate control, and to this extent

we are helpless. But our own influence is strong; our future lies more within our hands than within the hands of others. To cry with the fatalist that what is to be will be, is weak; nor can we thus evade our stern duty to do our utmost to shape our future to that form which we desire.

Our specialty is young. It is barely fifty-one years since Roentgen read his momentous communication "Concerning a New Sort of Rays" to the Physical-Medical Society of Würzburg, thus all unwittingly standing as a sort of combined midwife and godfather to an entirely new branch of medicine. Quite apart from the tremendous significance of Roentgen's discovery there are two astonishing events sequential to it. The first of these is the almost unimaginable impact of his announcement on both the scientific and the lay world. It is doubtful if ever before (and perhaps, even, ever again, until a stunned world heard of the destruction of Hiroshima) was scientific information so widely and so rapidly disseminated or so eagerly received as the news of Roentgen's discovery. The second amazing phenomenon is the speed with which medical use of the new rays was developed. The first roentgenogram was produced only ten days after Roentgen's first communication and was received by an awed medical world with varied reactions. Some foresaw the development of an extremely useful diagnostic method; some, represented notably by the surgeon Schonborn, warned against over-optimism, saying that the method scarcely promised to be of much, if any, value in the diagnosis of internal disorders. Dr. Schonborn is represented to this day

¹ Delivered Dec. 2, 1946, in Chicago, Ill.

by a small group who, for example, persist stubbornly in regarding the stethoscope as an instrument of great value in the examination of the chest. Within the first year after the announcement of the discovery of the x-rays, pulmonary tuberculosis was diagnosed by roentgen examination; a method for the localization of a foreign body in the eye was devised, and the first issue of the first journal devoted to Radiology appeared. In this same year, oil-immersed tubes were invented; double-focus tubes with vacuum regulation became available commercially, the intensifying screen was described, and the use of double-coated films between two screens was suggested.

I recall these events to your memory to point both the short elapsed time and the speed with which modern Radiology has developed. When one studies the program to be presented here this week, and reflects that the events just described have occurred within the lifetime of many of us, one may begin to realize both the youthfulness and the incredible growth of our specialty. Like all of the young, Radiology is vigorous, and sometimes a little brash. It's growth, like the growth of children, has been rapid, and like them it is unusually susceptible to attacks of various afflictions. The recognition of these truisms, the suppression of the brashness, and the diagnosis and the cure of our afflictions are among the things which rest within our hands, and which will shape our future.

"As a man thinketh in his heart, so is he," said Solomon, and his wisdom is reflected by the persistence of the proverb. As a sort of corollary, one might say that a man's fellows are likely to accept him at his own valuation, provided that his conduct bears out his contention. If we are to shape our own future or, at least, have a hand in its shaping, we must resolutely examine our conduct. I fear greatly that too many of us are still glorified technicians; that too few of us are true clinicians. Very recently a radiologist said to me that he had a distaste for therapy because he disliked dealing with patients, that he

much preferred to look at films. I presume that he was totally unaware that he had expressed his distaste for the practice of medicine. When told of a radiologist who had correctly diagnosed erosion and perforation of the appendix by a fecalith, and who, after seeing the film, had inquired as to the white blood cell count, a surgeon remarked, casually, that the radiologist simply hadn't ceased being a good doctor. Isn't this the goal for all of us—to be good doctors? It is, indeed. And on such a foundation, Radiology may erect an even more imposing structure than it now possesses. But the necessity is urgent; radiologists must be clinicians. They must see patients, they must read histories, they must witness surgical procedures, and they must frequent the pathologic laboratory and the autopsy room if they are to hold their own with other clinicians. We must strive for the extinction of the "film reader"; we must discourage the serving of multiple hospitals; we must deplore the virtual giving over of departments of radiology to the control of technicians while we pursue other profitable enterprises, and we must strive, vigorously, to make Radiology a true clinical specialty. Thus we may hope to survive as a free specialty, but unless we are prepared to render service superior to that which a man reasonably trained in his own field can furnish for himself, we will lose our reason for being and so our specialty will perish.

A factor which will shape the future of Radiology, and one partly within and partly outside our hands, is the role of the hospital in the medicine of the future. The origin of this problem is remote. The relationships that have developed between hospitals and radiologists were never conceived as formal and desirable plans; they simply developed without much direction from anyone. Many of you can remember the days of the Grosse Flamme coil, the Wehnelt interrupter, and the gas tube. The equipment was clumsy, undependable, and expensive. Its operation was not free from danger, and required a combination of physician, technician, electrician, and

general repair man to keep it functioning. The field of usefulness was comparatively limited; therapy was confined almost entirely to terminal cases, largely bedridden patients, and a hospital basement seemed the logical place for such activities as constituted a good deal of the practice of Radiology. Thus it began, and inasmuch as the rewards were largely spiritual, no great attention was paid to fiscal arrangements by either the hospital administration or the radiologist. Time slipped by; apparatus was constantly improved; knowledge increased vastly, and suddenly a medical specialty was found to be in bondage to boards of hospital trustees, and the hospital was discovered to be practising a branch of medicine through the medium of a paid physician.

No one is to blame for this situation; no one willed it into being, but there it is, urgently demanding solution. Simple in theory, but complex and difficult in application, that solution is simply this: hospital administrators must be brought to see clearly that their position in practising Radiology is no whit different than it would be if they practised surgery by the same device, and that they, the medical profession, and the public will all benefit if the current practices are abolished and that part of the practice of medicine called Radiology be returned to the physicians who make it their specialty. For our part, we must train our young radiologists in sound values, good practices, and the elements of medical economics.

The modern young radiologist is superbly trained. He is the professional equal of any man; his knowledge is extensive and profound. He has but one fault—he is too impatient. Unwilling, apparently, to struggle through the lean years of beginning, he demands an immediate reward for his efforts, and is commonly not too modest in his estimation of his worth. It is true that the fields of knowledge have become so vast that travel through them is long and tedious, and that more than one-third of a man's life is devoted to his progress from infancy to certification by a

specialty board. It is true that, because of this, young men are commonly encumbered with family responsibilities when at last they are ready to enter upon their careers. But, although these truths are equally applicable to the other special fields of medicine, one rarely if ever sees young surgeons or internists who harbor the faintest idea of any career other than private practice. Why, then, does our young radiologist seek a paid position in a hospital? Why does he not enter boldly into private practice as does his fellow of another specialty? One of the great social fallacies of today is the one which (euphemistically) is called "security." In the hope of reaching this mythical goal, our people are hopefully surrendering their most priceless possession—their freedom. Here, in our own field, we see the tragedy being re-enacted—hopeful of attaining at once to that desired "security," our young radiologist surrenders his professional freedom and his hope of true and permanent security to a hospital board, instead of tediously carving for himself a niche in the professional world. Read the annual report of the Professional Bureau of the American College of Radiology and observe for yourselves the sad procession of radiologists going from one job to another; moving one more step down the professional ladder as the young and vigorous come up to replace them; and reflect on the degree of security that has been obtained. Security in a profession consists in establishing oneself in a community as an independent and self-reliant professional man, and not in becoming an employee of a hospital, or of any other sort of institution.

Our future is being shaped to a considerable extent by the teachers of Radiology. Their influence on the young men they train is enormous, and justly so. But perhaps in their eagerness to inculcate the intricate science and art of Radiology, they sometimes forget their role in forming the future of their profession. To them I say: Encourage those whose lives you are shaping to face life boldly. Encourage private enterprise; hold up private practice as a

thing to be desired. Refrain from suggesting that only hospital radiology can offer a radiologist nourishment for his professional ambition. If it be true that more clinical entities will be seen in hospital practice, and that it offers a greater wealth of pathological material, then encourage the development of small groups of radiologists who may share such services, and thus you will fulfill at once your duty to your student and to your profession. The future of Radiology rests heavily in the hands of those who will practise it in future years. If they permit it to become submerged among hospital functions; if they exchange their professional birthright for a mess of pottage, then our future is dark indeed. But if they stand firm for the value and the dignity of their profession; if they are bold in their assertion of its independence; if they refuse to depart from the ranks of medicine into those of hospitalization, then we may hope for a bright and glorious future. In this much, then, the shaping of the future rests with us.

But Radiology is a department of medicine. We are physicians first and radiologists second, and our specialty rises or falls as the corporate destiny of medicine may determine. Organized medicine is a term rather loosely employed, and one that lacks the significance which it should have. Medicine is *not* well organized, but it must become so, or perish. All of us have been too busy in our work; too engrossed with the scientific aspects of our profession, and too absorbed in the care of our patients to give to organization the attention and the personal effort that it deserves. Organized medicine, so called, must become truly organized and must be truly representative of the physicians of America. We are among the physicians of America; it is our future that is at hazard, and it is our duty to work for its salvation. Let us put off, then, the garment of superior indifference; let us cease relegating to those whom we sometimes call (in a sort of superior fashion) the politicians, the duties and obligations which are so truly ours. Let us assume these with our other burdens, striv-

ing mightily that the right may prevail. If we turn coldly from this duty; if we are willing to leave the care of our destiny to those whom we are pleased to call the "politicians," let us remember that Plato said that if a man scornfully refuse his call to govern, his fate will be to be ruled by a worse one. From this foregoing, I have hoped to show how we may, perhaps, shape the future of Radiology, not only by our behavior as radiologists, but by our conduct as members of the profession of medicine.

But we are not only radiologists and physicians; we are citizens, we are Americans, and in that great capacity we have both our duty and a further opportunity to influence the future of our chosen branch of medicine. You are all well aware of the pressure for the enactment of compulsory health insurance, and of the constant struggle of the medical profession to prevent this misfortune from coming upon the people. You may well ask yourselves why there exists so persistent an effort to enact this legislation. All available evidence indicates that compulsory health insurance is a bad way to give medical care, and that in every country in which it has been established, its enactment has signaled the beginning of a lowering of health standards and a steady increase in the amount of sickness. As physicians, then—as humanitarians—we must be concerned with the possibility that compulsory health insurance may be forced upon us, and as radiologists, we must ask ourselves what the role of Radiology will be in such a system. Shall it continue to be recognized as a medical specialty? Will its practitioners be regarded as consultants? Have the proposed laws evidenced an intention so to regard us? Without hesitation, I predict that if compulsory health insurance is enacted into law, Radiology as a specialty will cease to exist.

To date, the writers of the various health insurance bills have shown no indication that they have the slightest grasp of the significance of our branch of medicine, or indeed, that they regard it or any kind of

medical specialty. Instead, they make vague references to diagnostic centers, to inclusion of radiological and laboratory services in hospitalization. In short, they make no provision whatever for the continued existence of Radiology. I need not dwell on the deterioration of medical care standards which would inevitably follow the disappearance of so essential a service as radiologic diagnosis and treatment. The treatment of our specialty in all of the health insurance bills which have thus far been written serves to point the fact that they are, in every instance, the product of non-medical minds; that they show but little grasp of the problems involved, and that their primary purpose is not to benefit the public health. On the contrary, they have been conceived by social planners, without medical advice. They follow a pattern established by the International Labor Office, which states flatly that the next step, and its goal, is the establishment of a national medical service to include all of the population, and to be under complete bureaucratic control. I have maintained in the past, and I am prepared to defend stoutly the thesis that this represents one more step toward the destruction of the American Republic and the erection of a national socialist state. It is here that all of us, in our capacities as American citizens, must defend our specialty by defending both our profession and our country.

Since the future of Radiology is bound up closely with that of medicine, and the future of medicine with that of our country, let us take orderly steps toward doing our part in the shaping of that future. We

must not content ourselves with attempting to direct the future of Radiology but, as physicians and as Americans, we must interest ourselves in the future of our profession and of our country. Let us direct both our teaching and our practice toward the preservation and the encouragement of free enterprise. Let us never cease crying that security, so called, is a dangerous delusion; that true security may be obtained only by personal effort, prudence, and sacrifice. There are those things which we can do within our own ranks, those which must be done within the corporate body of medicine, and there are those which must be done within the body politic of the nation. We must strive to serve the people well, putting service far ahead of gain. We must give to every man, without regard to his ability to pay, anything that we can give to preserve his health and life. We must so conduct our professional activities as to give the lie to those who cry that medical care can be had only by the well-to-do, and we must never cease to resist the social planner who would substitute for the magnificent civilization we have erected on this continent, the bare and meager social structure of Europe.

I repeat that the future is not predetermined or fixed. Destiny may still be altered by the will of men. The future remains malleable until that moment when it becomes history. While it remains within our power to do so, let us deal shrewd strokes, shaping our future to that form which will best serve the nation and our profession.

LOWELL S. GOIN, M.D.
Los Angeles, Calif.

ANNOUNCEMENTS AND BOOK REVIEWS

FOURTEENTH ANNUAL CONFERENCE TEACHERS OF CLINICAL RADIOLOGY

The Fourteenth Annual Conference of Teachers of Clinical Radiology was held in Chicago, under the auspices of the Commission on Education of the American College of Radiology, on Feb. 8. The morning session was devoted to a Round Table Discussion on The Undergraduate Teaching of Radiology, in which the following participated: Dr. Ross Golden, Dr. Shields Warren, Dr. H. Dabney Kerr, Dr. U. V. Portmann, Dr. F. W. O'Brien, Dr. B. R. Kirklin, and Dr. L. Henry Garland. The theme of the afternoon session was Postgraduate Training of Residents in Radiology. The speakers and their subjects were: Dr. Wm. A. O'Brien, "Selection of Residents for Training in Radiology"; Dr. Balduin Lucke, "Relation of the Pathologist to the Teaching and Practice of Radiology"; Dr. Edwin F. Hirsch, "What Constitutes Adequate Training for a Resident in Radiology"; Dr. U. V. Portmann, "Essential Requirements in Radiation Physics for the Resident in Radiology"; Dr. B. R. Kirklin, "What the Board of Radiology Expects of Residents in Radiology."

POSTGRADUATE COURSE ON NEOPLASTIC AND INFLAMMATORY DISEASE

The Commission on Education of the American College of Radiology, in co-operation with the Philadelphia Roentgen Ray Society, will conduct a postgraduate course in the diagnosis and treatment of certain neoplastic and inflammatory diseases, in Philadelphia, March 30-April 4, 1947. The instructors will include some of the outstanding teachers in the United States. Full information may be obtained from the American College of Radiology, 20 N. Wacker Drive, Chicago 6, Ill.

THE AMERICAN SOCIETY OF X-RAY TECHNICIANS

The American Society of X-Ray Technicians will hold its annual convention in Buffalo, N. Y., June 1-6, at the Statler Hotel. The General Chairman of the Convention Committee is Mina Kliman, R.T., 41 Butler Ave., Buffalo 8, N. Y.

THE FOURTH INTERNATIONAL CANCER RESEARCH CONGRESS

The Fourth International Cancer Research Congress will be held in St. Louis, Mo., Sept. 2-7, 1947, with headquarters at the Hotel Jefferson. The Union Internationale contre le Cancer having accepted the invitation of the American Association for Cancer Research, the Congress will be held under

the joint auspices of these two organizations, with Dr. E. V. Cowdry, Professor of Anatomy, Washington University School of Medicine and Director of Research of the Barnard Free Skin and Cancer Hospital, St. Louis, serving as President.

AMERICAN INSTITUTE OF PHYSICS

Reorganization of the American Institute of Physics and plans for a new semi-popular journal devoted to the fast-growing science and its relation to society have recently been announced. Dr. Paul E. Klopsteg, Director of Research of the Technological Institute, Northwestern University, is chairman of the Institute, and Dr. Henry A. Barton is its director. Headquarters are at 57 East 55th St., New York, N. Y.

ARMY WEEK

In co-operation with the U. S. War Department, and at its request, announcement is made of the observance of Army Week, April 6-12, 1947.

In Memoriam

FRED YORK DURRANCE, M.D.

Dr. Fred York Durrance, of Houston, Texas, died on Oct. 20, 1946, of coronary thrombosis at the age of 53. He was born in Arcadia, Fla., in 1893 and was educated in the University of Florida and Tulane University, taking special training in roentgenology. He practised at Beaumont, Texas, for four years prior to moving to Houston in 1931. He was Chief of the Roentgenological Service at Hermann Hospital and had served in the same capacity at the Southern Pacific Hospital.

Dr. Durrance was Associate Professor of Radiology at Baylor University College of Medicine and took an active part in teaching. He co-operated also in the instruction of a large intern and resident group at Hermann Hospital. He was a member of the Harris County Medical Society, the Radiological Society of North America, and Houston Academy of Medicine, a fellow of the American College of Radiology, and a diplomate of the American Board of Radiology. He worked unceasingly for the establishment of the practice of radiology in his hospital according to the tenets of the American College of Radiology and his successors will be the benefactors of his efforts.

Surviving Dr. Durrance are his wife, Mrs. Sybil R. Durrance, now president of the Harris County Medical Society Auxiliary, and a son, Fred. Jr.

PALMER E. WIGBY, M.D.

RAYMOND V. MAY, M.D.

Dr. Raymond V. May, of Cleveland, Ohio, for many years on the staff of St. Lukes Hospital in that city and president of the recently organized Fairhill Hospital, died Dec. 28, 1946, after an illness of about a year. Death occurred in his home on Westlake Road in Bay Village.

Dr. May was graduated from Western Reserve University in 1913 and served his internship at Cleveland City Hospital. Following this, he was engaged in the general practice of medicine in New London, Ohio, for a period of five years. He became associated with his brother, Dr. Robert J. May, in 1920, practising radiology in Cleveland. Dr. May joined the Radiological Society of North America in 1925 and the Cleveland Radiological Society the same year. He became a diplomate of the American Board of Radiology in 1935 and a member of the American College of Radiology in 1937.

Dr. May's diligence and quiet friendliness will be long remembered by all those with whom he came in contact. He was regular in his attendance at the meetings of the Radiological Society and his fellow-

ship will be greatly missed. He is survived by his wife and four children.

GEORGE L. SACKETT, M.D.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

APPLIED ANATOMY OF THE HEAD AND NECK FOR STUDENTS AND PRACTITIONERS OF DENTISTRY. HARRY H. SHAPIRO, D.M.D., Assistant Professor of Anatomy, College of Physicians and Surgeons, Columbia University. A volume of 303 pages, with 221 illustrations. Published by J. B. Lippincott Co., Philadelphia, 2d edition, 1947.

CONFRONTATIONS RADIO-ANATOMO-CLINQUES. Published under the direction of M. CHIRAV, R. A. GUTMANN, and J. SÉNÈQUE. Fascicule 1. A volume of 56 pages, with 98 figures. Published by Masson & Cie, Editeurs, Paris, 1946. Price 370 fr.



RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to cooperate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates. Address: Howard P. Doub, M.D., The Henry Ford Hospital, Detroit 2, Mich.

UNITED STATES

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 607 Medical Arts Bldg., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, Hugh F. Hare, M.D., 605 Commonwealth Ave., Boston 15, Mass.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Harold Dabney Kerr, M.D., Iowa City, Iowa.

AMERICAN COLLEGE OF RADIOLOGY. *Secretary*, Mac F. Cahal, 20 N. Wacker Dr., Chicago 6, Ill.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, U. V. Portmann, M.D., Cleveland Clinic, Cleveland 6, Ohio.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John Day Peake, M.D., Mobile Infirmary, Mobile. Next meeting at the time and place of the Alabama State Medical Association meeting.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and annually at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, D. R. MacColl, M.D., 2007 Wilshire Blvd., Los Angeles 5.

LOS ANGELES COUNTY MEDICAL ASSOCIATION, RADIOLOGICAL SECTION. *Secretary*, Moris Horwitz, M.D., 2009 Wilshire Blvd., Los Angeles 5. Meets second Wednesday of each month at County Society Bldg.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually with California Medical Association.

SAN DIEGO ROENTGEN SOCIETY. *Secretary*, R. F. Niehaus, M.D., 1831 Fourth Ave., San Diego. Meets first Wednesday of each month.

SAN FRANCISCO RADIOLOGICAL SOCIETY. *Secretary*, Joseph Levitin, M.D., 516 Sutter St., San Francisco 2. Meets monthly on the third Thursday at 7:45 P.M., first six months of the year in Lane Hall, Stanford University Hospital, and second six months in Toland Hall, University of California Hospital.

Colorado

DENVER RADIOLOGICAL CLUB. *Secretary*, Washington C. Huyler, M.D., Mercy Hospital, 1619 Milwau-

kee, Denver 6. Meets third Friday of each month, at the Colorado School of Medicine and Hospitals.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Robert M. Lowman, M.D., Grace-New Haven Hospital, Grace Unit, New Haven. Meetings bimonthly, second Thursday.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maxey Dell, Jr., M.D., 333 West Main St., S., Gainesville.

Georgia

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James J. Clark, M.D., 478 Peachtree St., N. E., Atlanta 3. Meets in November and at the annual meeting of State Medical Association.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, T. J. Wachowski, M.D., 310 Ellis Ave., Wheaton. Meets at the Palmer House, second Thursday of October, November, January, February, March, and April, at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly by announcement.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Frank S. Hussey, M.D., 250 East Superior St., Chicago 11.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, J. A. Campbell, M.D., Indiana University Hospitals, Indianapolis 7. Annual meeting in May.

Iowa

IOWA X-RAY CLUB. *Secretary*, Arthur W. Erskine, M.D., 326 Higley Building, Cedar Rapids. Meets during annual session of State Medical Society.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney E. Johnson, M.D., 101 W. Chestnut St., Louisville.

Louisiana

LOUISIANA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Johnson R. Anderson, M.D., No. Louisiana Sanitarium, Shreveport. Meets with State Medical Society.

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, Oscar O. Jones, M.D., 2622 Greenwood Road. Meets monthly September to May, third Wednesday, 7:30 P.M.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary*, Charles N. Davidson, M.D., 101 West Read St., Baltimore 1.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary-Treasurer*, E. R. Witwer, M.D., Harper Hospital, Detroit 1. Meetings first Thursday of each month from October to May, at Wayne County Medical Society club rooms.

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS. *Secretary-Treasurer*, R. B. MacDuff, M.D., 220 Genesee Bank Building, Flint 3.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, C. N. Borman, M.D., 802 Medical Arts Bldg., Minneapolis 2. Regular meetings in the Spring and Fall.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, John W. Walker, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Edwin C. Ernst, M.D., 100 Beaumont Medical Bldg. Meets on fourth Wednesday of each month, October to May.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, O. A. Neely, M.D., 924 Sharp Building, Lincoln. Meetings third Wednesday of each month at 6 P.M. in either Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, George Levene M.D., Massachusetts Memorial Hospitals, Boston, Mass. Meets monthly on third Friday at Boston Medical Library.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary-Treasurer*, Albert C. Johnston, M.D., Elliot Community Hospital, Keene. Meetings quarterly in Concord.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, W. H. Seward, M.D., Orange Memorial Hospital,

Orange. Meetings at Atlantic City at time of State Medical Society and midwinter in Newark as called.

New York

ASSOCIATED RADIOLOGISTS OF NEW YORK, INC. *Secretary*, William J. Francis, M.D., East Rockaway, L. I.

BROOKLYN ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Abraham H. Levy, M.D., 1354 Carroll St., Bklyn. 13. Meets fourth Tuesday of every month, October to April.

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday evening each month, October to May, inclusive.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary-Treasurer*, Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse 10. Meetings in January, May, and October.

LONG ISLAND RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

NEW YORK ROENTGEN SOCIETY. *Secretary*, Wm. Snow, M.D., 941 Park Ave., New York, 28.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary*, Murray P. George, M.D., 260 Crittenden Blvd., Rochester 7. Meets at Strong Memorial Hospital, third Monday, September through May.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary-Treasurer*, James E. Hemphill, M.D., Professional Bldg., Charlotte 2. Meets in May and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary*, Charles Heilman, M.D., 1338 Second St., N., Fargo.

Ohio

OHIO RADIOLOGICAL SOCIETY. *Secretary*, Henry Snow, M.D., 1061 Reibold Bldg., Dayton 2. Next meeting at annual meeting of the Ohio State Medical Association.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Hugh A. Baldwin, M.D., 347 E. State St., Columbus.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, George L. Sackett, M.D., 10515 Carnegie Ave., Cleveland 6. Meetings at 6:30 P.M. on fourth Monday, October to April, inclusive.

RADIOLOGICAL SOCIETY OF THE ACADEMY OF MEDICINE (Cincinnati Roentgenologists). *Secretary-Treasurer*, Samuel Brown, M.D., 707 Race St., Cincinnati 2. Meets third Tuesday of each month.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Peter M. Russo, M.D., 230 Osler Building, Oklahoma City. Meetings three times a year.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, Calvin L. Stewart, M.D., Jefferson Hospital, Philadelphia 7. Meets first Thursday of each month at 8:00 P.M., from October to May in Thomson Hall, College of Physicians, 21 S. 22d St.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, Lester M. J. Freedman, M.D., 415 Highland Bldg., Pittsburgh 6. Meets second Wednesday of each month at 6:30 P.M., October to May, inclusive.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, A. M. Popma, M.D., 220 N. First St., Boise, Idaho.

South Carolina

SOUTH CAROLINA X-RAY SOCIETY. *Secretary-Treasurer*, Robert B. Taft, M.D., 103 Rutledge Ave., Charleston 16.

Tennessee

MEMPHIS ROENTGEN CLUB. Meetings second Tuesday of each month at University Center.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frère, M.D., 707 Walnut St., Chattanooga. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. *Secretary*, X. R. Hyde, M.D., Medical Arts Bldg., Fort Worth 2. Meetings on third Monday of each month, in Dallas in the odd months and in Fort Worth in the even months.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth 4.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, M. Lowry Allen, M.D., Judge Bldg., Salt Lake City 1. Meets third Wednesday, January, March, May, September, November.

UNIVERSITY OF UTAH RADIOLOGICAL CONFERENCE. *Secretary*, Henry H. Lerner, M.D. Meets first and third Thursdays, September to June, inclusive, at Salt Lake County General Hospital.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, E. Latan Flanagan, M.D., 215 Medical Arts Bldg., Richmond 19.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Frederic E. Templeton, M.D., 324 Cobb Bldg., Seattle 1. Meetings fourth Monday, October through May, at College Club, Seattle.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, C. A. H. Fortier, M.D., 231 W. Wisconsin Ave., Milwaukee 3. Meets monthly on second Monday at the University Club.

RADIOLOGICAL SECTION OF THE WISCONSIN STATE MEDICAL SOCIETY. *Secretary*, S. R. Beatty, M.D., 185 Hazel St., Oshkosh. Two-day meeting in May and one day at annual meeting of State Medical Society in September.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursdays 4 to 5 P.M., September to May, inclusive, Room 301, Service Memorial Institute, 426 N. Charter St., Madison 6.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer*, E. M. Crawford, M.D., 2100 Marlowe Ave., Montreal 28, Quebec. Meetings in January and June.

LA SOCIÉTÉ CANADIENNE-FRANCAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES. *General Secretary*, Origène Dufresne, M.D., Institut du Radium, Montreal. Meets on third Saturday of each month.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPIA DE CUBA. Offices in Hospital Mercedes, Havana. Meets monthly.



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ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Importance of Air Studies in a Neurosurgical Clinic. Gilbert Horrax. *Surgery* 19: 725-730, May 1946.

Since the introduction of ventriculography and encephalography by Dandy in 1918 and 1919, these procedures have become indispensable in the differential diagnosis of intracerebral disease. Before the use of air studies of the brain, from 50 to 60 per cent of brain tumors could be localized with sufficient accuracy to be found at operation. Of the remaining 40 to 50 per cent, practically all are demonstrable following the introduction of air into the ventricles. When it is realized that approximately half of all intracranial tumors found at operation are totally removable, the significance of these figures is apparent.

At the Lahey Clinic (Boston), during the year ending April 30, 1945, 429 cerebral air studies were done, including 323 encephalograms and 106 ventriculograms. Ventriculography, or the direct injection of air into the ventricles through burr openings in the skull, was used in those cases in which there were indications of considerable increase of intracranial pressure, from whatever cause. This procedure was instituted to obtain information on three major points: (1) to diagnose the presence or absence of a brain tumor in patients with choked disks and other pressure symptoms but no localizing signs; (2) to localize a brain tumor when neurologic and other data gave no indication of its site; (3) to locate the site of a tumor more exactly, when some localizing evidence was already present. Cases illustrating each of these points are presented. [Points 1 and 2 appear to the abstractor to be identical.]

Encephalography, or displacement of the cerebrospinal fluid through lumbar injection of air, finds a wider field of application than ventriculography. Occasionally, an unsuspected intracranial new growth is discovered, as was the case in 9 of the 323 encephalographic studies in this series. Perhaps the most important diagnostic function of encephalography is the differentiation of cerebral vascular disease and possible tumors. This procedure is used to help in solution of the following problems of diagnosis and treatment: (1) to distinguish cerebral vascular and degenerative disease from tumor; (2) to demonstrate the presence or absence of a localized lesion in epilepsy; (3) to demonstrate the existence of an obstructive or a communicating hydrocephalus in children; (4) to demonstrate the presence or absence of a possible cerebral or high cervical lesion (such as Arnold-Chiari syndrome) in patients in whom multiple sclerosis or cerebrospinal degenerative disease is the probable diagnosis; (5) to make sure that no possible intracranial surgical lesion exists in certain cases of presumed cerebral birth injury; (6) as a therapeutic measure in post-traumatic headache.

The use of encephalography in post-traumatic headache was first reported by Penfield in 1927, who had 7 patients who were relieved by this procedure. During the period covered by this communication, air insufflation was used on 22 patients with post-traumatic headaches. While the percentage of cures cannot yet be determined, it is the impression of the author that three out of four patients were relieved.

J. E. WHITELEATHER, M.D.

Treatment of an Unusual Subdural Hydroma (External Hydrocephalus). Walter E. Dandy. *Arch. Surg.* 52: 421-428, April 1946.

There are two types of external hydrocephalus, congenital and post-traumatic. The latter is usually due to a tear in the arachnoid beyond the cisterna and in many instances undergoes spontaneous cure when the tear closes. The presence of a valve action is important in the development of a subdural hydroma. The condition will not occur in the presence of an opening communicating freely with the cisterna.

A case is reported of a two-year-old child in whom a subdural hydroma developed following a fall. Drainage and decompression had been attempted before the patient was seen by the author but did not relieve the condition. Encephalograms showed a small ventricular system pushed 6 cm. to the right and a large bed of air over the left side and between the falx and cerebrum. The old craniotomy wound was reopened and revealed a huge amount of fluid over the left hemisphere. Since the location of the tear could not be determined, the falx and adjacent cerebrum were swabbed with 3.5 per cent iodine solution to cause adhesion. After a somewhat stormy course the child recovered. He remained well six months later.

The encephalograms are reproduced and their interpretation is discussed. LEWIS G. JACOBS, M.D.

Surgical Treatment of Vascular Anomalies of the Premotor Area Producing Epilepsy. Frederick L. Reichert. *Surgery* 19: 703-724, May 1946.

While this paper is written primarily from the point of view of the surgeon, it may be of interest to the radiologist as describing a new ventriculographic sign in callosal angiomas. In 3 cases of this condition, proved by ventricular needle puncture, the ventriculograms showed separation of the bodies of the lateral ventricles.

Fibro-Osteoma. A Pathologico-Anatomical and Roentgenological Study. Lars Billing and Nils Ringertz. *Acta radiol.* 27: 129-152, March 30, 1946. (In English.)

In the past seven or eight years fibro-osteoma, a tumor-like formation usually involving the jaw or cranial bones, has become known as a pathological entity. It has been described under such designations as ossifying fibroma, osteofibroma, central fibroma of the jaws, etc. A number of cases previously classified as leontiasis ossea probably belong in this group. The tumor consists of a matrix of connective tissue in which clumps and spicules of bone are present. There is no cartilage and the lesion is closely connected with the normal bony structure as a localized enlargement. The authors recognize four types, showing progressive maturity of the cellular elements. They note that osteoclastic changes may occur in the more mature forms. There is some difference in opinion as to the pathogenesis, but the authors believe that the tumor is a malformation in growth rather than a true neoplasm.

The most frequent site is the jaws, but any part of the cranium may be involved, the most usual location being the bones of the face and anterior part of the skull. The authors present in tabular form 21 cases, in one of which the tumor occurred in a rib. The incidence is higher in young persons, and symptoms are chiefly

mechanical. In two reported cases of long duration sarcomatous change ensued, but the tumor did not resemble osteogenic sarcoma.

Roentgenologically the findings are often pathognomonic, but there is variation depending upon the location and microscopic type. The eburnified fibro-osteoma produces a dense structureless picture. In the mature but not eburnified type slender spicules can be seen in the form of whorls and garlands, or irregularly arranged so that there may be a resemblance to the "stippling of the rind of an orange." In the less mature types, the calcified structures may be so small that they do not appear on the roentgenogram. Differential diagnosis includes Paget's disease, osteitis fibrosa, the localized sclerosis caused by meningiomas, sarcomas, and inflammatory processes and, for the immature type, adamantinoma.

ELIZABETH A. CLARK, M. D.

Cephalhematoma Deformans: Late Developments of Infantile Cephalhematoma. A. Schüller and F. Morgan. *Surgery* 19: 651-660, May 1946.

Five cases in which unusual sequelae of infantile cephalhematomata persisted until adult life, are reported. The essential features of the condition are: (1) a history dating back to infancy or childhood (a cranial injury is mentioned in 4 of the 5 cases); (2) a peculiar bulging of the forehead, more pronounced on one side; (3) a circumscribed cranial hyperostosis presenting an unusual and bizarre structure. In 4 of the cases no sign or symptom of intracranial or ocular disorder was present. One patient had headache and protrusion of the eyeball developing suddenly at the age of twenty years, probably due to fresh hemorrhage.

The roentgen appearance is described as thickening of the cranial bones, up to 6 cm. in one case. This thickening is mainly eccentric, and merges gradually into normal bone. The structure of the hyperostosis is not uniform: diploe lined by thin external and internal laminae prevail in the thickened calvaria; eburnated hyperostosis is present in the basal area. There may be osteoporosis, osteosclerosis (similar to that seen in Paget's disease), cystic cavities, and bony fragments resembling sequestra. The paranasal sinuses may be absent on the diseased side; if present, they may be of atypical shape. The pathological process is described as new bone formation under the periosteum elevated by the hematoma. This new bone may disappear partly or completely. It may undergo porotic, sclerotic, or cystic changes. Fresh hemorrhage may occur.

Conditions to be differentiated include osteoma, chondroma, sarcoma, leontiasis ossea, meningioma hyperostosis, hyperostosis combined with facial nevi and angiomas, syphilitic hyperostosis, hyperostotic type of xanthomatosis, hyperostosis in neurofibromatosis (Recklinghausen), osteitis fibrosa cystica, Albright's disease, hyperostotic oxycephaly, hypertelorismus (Greig), mucocele of the paranasal sinuses, cholesteatoma of the cranial bones or of the paranasal sinuses.

In none of the authors' series was operation required. The name "cephalhematoma deformans" is proposed for this condition. J. E. WHITELEATHER, M.D.

Hyperparathyroidism and Parathyroid Adenoma. Three New Zealand Cases. D. Whyte. *New Zealand M. J.* 45: 88-94, April 1946.

Three cases of parathyroid adenoma of varying symptomatology are presented. Two lay behind the thyroid

fascia and one in the anterior mediastinum. Each possessed a well marked vascular pedicle.

Tumors of the jaws and eventually the skeletal changes of osteitis fibrosa cystica developed in the first patient over a period of twelve years. Roentgenograms showing cystic formations in the femora and ischium, with patches of thinned, irregular cortex of long bone and decalcification, and a high serum calcium were diagnostic. X-ray studies nine months after surgical removal of the parathyroid tumor showed marked bone repair.

In the second case skeletal changes were minor and not characteristic.

In the third case the first symptom was renal colic and a calculous kidney was removed. Nocturnal frequency and symptoms related to softening of the skeleton were present for the next five years. Roentgenograms showed widespread localized areas of destruction in the pelvis, right upper femur, and left patella. Serum calcium and phosphorus values were high. Surgical exploration of the neck revealed no parathyroid tumor and a subtotal removal of the left thyroid lobe was done. A biopsy of a cystic area of the tibia showed an osteoclastoma. Bone changes in the pelvis and upper femora progressed, culminating in a pathological fracture of the superior pubic ramus. A parathyroid tumor weighing 21 gm. was found at a second operation by a trans-sternal approach.

Radioiodine Autography in Studies of Human Goitrous Thyroid Glands. C. P. Leblond, M. Been Fertman, I. D. Puppel, and George M. Curtis. *Arch. Path.* 41: 510-515, May 1946.

Radioiodine was administered orally to patients with diffuse colloid and exophthalmic goiter before subtotal thyroidectomy. Subsequent autographic study of the removed glands showed that the iodine was rapidly deposited in a stable form in the colloid part of the thyroid follicle.

THE CHEST

Intrapulmonary Air Pressure and Its Relation to Pulmonary Capillary Flow. W. Walter Wasson. *Am. J. Roentgenol.* 55: 575-587, May 1946.

The author's object in this paper is to call attention to the importance of the intrapulmonary air pressure, that is, the air column within the bronchi and air sacs. There is a very close association between the functions of respiration and the pulmonary circulation. After the initial drop in blood pressure within the pulmonary artery following the first inspiration, the relation of one to four or five between the pressure within the pulmonary artery and the aorta is maintained throughout life except in certain disease conditions. There is very little increase in the thickness of the right ventricular wall after birth.

The pulmonary capillaries have an area of 140 square meters. It must be that the capillaries can handle the supply of blood from the heart with the same ease that the air sacs handle the exchange of air in respiration. With the capillaries bare in the walls of the air sacs, the support given by the air column must be very necessary to offset the action of the elastic fibers of the air sacs and the pleura. On inspiration there is a lower pressure within the air sacs, and air rushes in; but with this same inrush of air there must be an inflow of blood into the pulmonary capillaries from the pulmonary artery.

When the chest wall descends and the negative pressure within the pleural space returns to -5 mm. of mercury, the elastic fibers contract and squeeze out the air, creating for the moment a positive air pressure in the air sacs and bronchi. This action must also certainly squeeze the capillaries between the elastic fiber framework on the one side and the air column on the other. The result is a pressure exerted over 140 square meters of capillary surface and the flow of blood is into the veins rather than into the pulmonary artery. A repetition of this action at each inspiration and expiration creates a pumping action upon a large volume of blood, and must be quite effective. In other words, inspiration and expiration may not only pump the air in and out of the lungs but also pump the blood through the pulmonary capillaries. In atelectasis and pneumonia, there is not only the interference with the capillary flow by compression of the capillaries but also the loss of this auxiliary to the propelling force of the heart action.

A brief summary of the literature is given and important known facts are reviewed concerning the anatomy and physiology of the air sacs and the circulation within the pulmonary capillaries.

CLARENCE E. WEAVER, M.D.

Double-Exposure Radiograms of Chest. James Maxwell. *Lancet* 1: 499-500, April 6, 1946.

A composite roentgenogram showing the respiratory excursion has been found informative in certain chest conditions and should prove of value in the teaching of anatomy and physiology. The same film is exposed twice, on maximal expiration and inspiration, and the extent of movement of the ribs and diaphragm is clearly recorded. The exposure time is kept constant and the kilovoltage varied. (On a machine with a delicate timing switch graduated at least in twentieths of a second, an alternative technic is to maintain a standard kilovoltage and to vary the exposure.) The author's technic is similar to that described by Vickers (*Brit. J. Radiol.* 18: 229, July 1945). The first exposure is made on full expiration, using the milliamperes-seconds factor which would be used for a standard chest film, but increasing the standard kilovoltage slightly ($x + 5$). The second exposure is then made on full inspiration, using the same milliamperes-seconds factor and lowering the kilovoltage to a corresponding extent ($x - 5$ or -10). In this way a sharp double outline of the diaphragm can be seen, and the movement measured. For an accurate study of the diaphragm, the tube should be centered on a level with the muscle, about the plane of the 9th dorsal vertebra, but when this is done, it is impossible to include the movements of the ribs. To record the movement of the chest as a whole, for the movements of the diaphragm and ribs should be complementary, it is necessary to center the tube in the usual way. The diaphragmatic movement appears to be a little less than it actually is, but films taken in this way are comparable with each other, and the degree of inaccuracy is relatively slight.

The "Wet Lung" in War Casualties. Lyman A. Brewer, III, Benjamin Burbank, Paul C. Samson and Charles A. Schiff. *Ann. Surg.* 123: 343-362, March 1946.

The problem of the wet lung, *i.e.*, the persistence of fluid in the pulmonary tree, following trauma is discussed, on the basis of the authors' combined experience in the management of over 770 casualties in which the chest wound was the primary concern and of the

thoracic complications arising in over 3,000 other casualties of all types. Fluid may be present in various forms—mucus, blood, serum, etc. Two groups of factors are of importance in the development of wet lung: (1) forces leading to the production of secretions and other fluids in abnormal amounts in the respiratory tract and (2) conditions preventing adequate removal of the fluids so produced. In war casualties many conditions are present which favor both the accumulation and inadequate expulsion of fluid material from the pulmonary tree.

The recognition of the syndrome in its earlier stages should lead to vigorous treatment and may often prevent the development of graver complications. One of the most frequent findings is an almost constant "wet cough." On physical examination there are two outstanding features: dyspnea and bronchial râles. Râles may not be elicited unless auscultation is made immediately after coughing. Frequently, sticky mucus attached to the tracheal or bronchial wall or the completely obstructed branch bronchus will not present the physical signs of râles. Fine crackles heard with the stethoscope over the patient's mouth on respiration is a sensitive index of moisture in the bronchial tree. In early cases, the evidence of moisture heard with the stethoscope is the most important physical sign. In advanced cases diagnosis is usually simple and can be frequently made at a distance by the dyspnea and audible râles. The character of the sputum is of diagnostic significance.

In war casualties arriving at Field or Evacuation Hospitals in shock or with wet pulmonary tree, treatment must precede roentgen examination. The frequent coexistence of extensive thoracic wall, pleural, or intrapulmonary lesions makes the shadows due to partial or complete bronchial obstruction very difficult to interpret. In the early stages of wet lung, roentgen findings are minimal and a considerable degree of obstruction may be present without roentgenographic evidence. Roentgenograms in two planes should be taken whenever possible. When any question arises, more weight should be placed on the clinical picture. In certain instances, the information gained by the taking of the intrapleural pressure readings aids in the interpretation of roentgen findings. Patchy lobular atelectasis is seen early in these cases and may be indistinguishable from shadows due to pulmonary hematoma. Later, when lobular or total pulmonary atelectasis is present, the collapse of these parts of the lung produces the classical signs of mediastinal shift and narrowing of the intercostal spaces.

The most important therapeutic measures are intercostal nerve block, tracheobronchial aspiration either with the catheter or the bronchoscope, and positive-pressure oxygen therapy. Illustrative case reports are presented.

Diagnosis of Vegetal Foreign Bodies in the Lower Respiratory Tract. Raymond S. Rosedale. *Ohio State M. J.* 42: 375-377, April 1946.

One of the most important features in the diagnosis of a foreign body in the tracheobronchial tree is a history of choking or gagging while eating nuts. After these initial symptoms, there is usually a symptom-free interval of one day to several weeks. With the development of vegetal bronchitis, cough reappears. Expectoration is at first mucoid, then purulent or even bloody, the amount of sputum depending upon the degree of ob-

struction. With obstructing foreign bodies and retention of secretion, there may be chills, fever, and other evidences of toxicity.

Wheezing may or may not be present. Breath sounds may be diminished or suppressed over the affected portion of the lung, while those on the opposite side may be exaggerated. Tactile and vocal fremitus are diminished. The percussion note may be flattened if atelectasis is developing, or tympanitic if emphysema is present. Inspection of the chest in a good light, with special attention to unilateral impairment of expansion and mobility, is of particular importance.

In the early stages radiographs may show no departure from normal. As secondary lung changes develop, the findings depend on the type, degree, and site of the bronchial obstruction. If a main bronchus is totally obstructed, atelectasis of the involved area will follow, with increased density over the entire lung and shift of the trachea and mediastinum toward the involved side. The intercostal spaces will be narrow and the diaphragm may be elevated. A so-called compensatory emphysema of the opposite lung may occur.

If the foreign body has a ball-valve action, the primary effect will be a trapping emphysema with gradual over-distention of the affected portion of the lung. In such a case the trachea and mediastinum will be shifted toward the opposite side, the intercostal space will be widened, and the diaphragm on the affected side will be depressed.

It is always best to obtain films at the end of inspiration and at the end of expiration. Rupture of the emphysematous lung may produce a pneumothorax with typical appearance, or an interstitial pulmonary emphysema may develop, with a mottled appearance due to contrasting pockets of air around the vascular and bronchial radicles.

The foreign body may not obstruct a main bronchus but a secondary one, in which event a lobe or a portion of a lobe will be affected. When a foreign body has been in place for some time, secondary pulmonary pathological changes may develop, such as multiple abscesses, hydrothorax, or pyothorax. It may be necessary to use over-penetrated films to delineate the primary condition in such instances.

The authors feel it advisable to have a check x-ray examination of the chest three days following removal of a foreign body and, if no complications develop, again on the seventh day.

BERNARD S. KALAYJIAN, M.D

An Investigation into the Radiological Appearances of the Chests of Workers Engaged in the Production of Toxic Gases. P. H. Whitaker. *Brit. J. Radiol.* 19: 158-164, April 1946.

Irritant gases produce either a primary pulmonary edema or an acute pneumonitis with pulmonary edema as a secondary and incidental manifestation. Phosgene is an example of the first type and mustard gas of the second.

Radiological appearances are of two types: (1) an even density around the hila, becoming increasingly less toward the periphery of the lung fields; (2) scattered changes—consolidation and opacity—similar to those of miliary tuberculosis. Between these two, the author states, there must be degrees of less severity, with only minor changes visible in the lungs. As an example he mentions a study of six persons who had been exposed to phosgene, all of whom had a mild degree of dyspnea.

The radiographs showed only a mild increase in the hilar density, an increase in the markings around the roots, and a slight increase in the lung reticulation. These changes persisted for varying times up to fourteen days, even after symptoms had disappeared.

Studies were also made on workers engaged in the manufacture of gases of the mustard type. Those exposed to certain chemical processes were found to have a persistent brassy cough. Chest roentgenograms of men who had been coughing for three or four months showed little change from normal, but in all there was a slight increase in the root markings at the lung bases. In view of the constancy of this latter finding, the study was extended to 105 workmen in another mustard gas factory. After six months of employment 6 examples of increased density of the hilar markings and increased striation of the basal root markings were discovered among men giving essentially normal findings before they commenced work. A final examination, a year after the first, following some decrease in exposure, showed improved radiological appearances.

The author assumes from his observations that the lung changes are probably of a simple congestive type and of no serious pathological significance. They tend to regress with cessation of exposure to the irritant.

SYDNEY J. HAWLEY, M.D.

Significance of Roentgen Examination for Diagnosis and Differential Diagnosis of Acute Interstitial Pneumonia. R. Lenk. *Acta radiol.* 27: 115-128, March 30, 1946. (In German.)

The role of roentgen examination in the diagnosis of acute interstitial pneumonia (virus pneumonia) is discussed and the great variability of the radiographic manifestations of this disease is stressed. The author describes three types, none of which however is considered characteristic. After discussing the radiographic differential diagnosis, he concludes that the combination of some of the radiographic manifestations with fever shortly after the onset of illness permits the diagnosis of acute interstitial pneumonia with a fair amount of probability.

F. ELLINGER, M.D.

Primary Atypical Pneumonia, Virus Type. A Brief Review—Necropsy Presentation. Jack C. Norris, Richard F. McLaughlin, and S. Francis Williams. *Mil. Surgeon* 98: 299-304, April 1946.

A fatal case of atypical pneumonia is reported, with necropsy findings. The authors believe that trauma, such as smoke or gas irritation, or fractured limbs and ribs, initiates the disease in some instances and mention the possibility that allergy may be important in this regard. In the case presented, the occurrence of symptoms relative to the nervous system is emphasized, with the suggestion that the pneumonia might be related to the encephalitic infections. Inflammatory lesions were present in this patient's heart; a finding not previously recorded in such cases.

Bronchopneumonia Following Ether Anesthesia in Obstetrics. Homer C. Hartzell and Edward P. Mininger. *Surg., Gynec. & Obst.* 82: 427-433, April 1946.

Twenty cases of bronchopneumonia which developed following obstetrical delivery with ether inhalation anesthesia were observed. Clinically, the pneumonia did not prove a cause of serious illness and no fatalities resulted. Its chief cause was the aspiration of gastric

contents as a result of vomiting. The possible contributory role of (1) preanesthetic medication, favoring suppression of the cough reflex, (2) prolonged gastric evacuation in labor, and (3) fluidity of the gastric contents, favoring their dissemination in the bronchial tree, is discussed.

The bronchopneumonias varied in extent from isolated patches to extensive bilateral infiltrations and were observed in all portions of the lung fields. The less extensive cases presented the picture of "soft" fluffy localized shadows of increased density which, when situated in the upper lung fields, closely simulated the early infiltrations of adult tuberculosis. The more extensive bilateral cases showed symmetric extensive coalescent densities, with a tendency to central localization, resembling pulmonary edema. A variety of intervening patterns were also seen, indistinguishable from bronchopneumonias due to other causes. Usually there was an associated generalized increase in prominence of the vessel markings, suggestive of pulmonary hyperemia. None of the patients showed mediastinal displacement or other evidence of massive atelectasis.

Clearing of the infiltration was rapid in most cases and complete in all. Fifteen of 18 cases in which serial films were available showed complete clearing in a week or less.

On strictly objective criteria, a roentgen diagnosis of aspiration pneumonia is not possible, but its recognition is usually easy if the roentgenologist knows the clinical findings and is familiar with the condition. It is differentiated from both pulmonary tuberculosis and sarcoidosis by its rapidity of clearing as seen on serial films. It differs from lobar or massive atelectasis in its patchy character and in the absence of mediastinal displacement. Dependence must be placed upon the clinical findings to differentiate it from bronchopneumonias and pulmonary edemas of other etiology.

Roentgen and Clinical Problems in So-Called Solitary Metastatic Tumors in the Chest. Frederick B. Mandeville. *Am. J. Surg.* 71: 669-675, May 1946.

The author points out that with increased skill and experience of thoracic surgeons the responsibilities of the roentgenologist for the diagnosis of chest tumors has become correspondingly heavier. He presents brief accounts of 5 cases of solitary metastatic chest tumors seen in his own radiologic experience. Pneumonectomy was done in 4 cases. One patient died in the operating room; 2 died less than a year following operation; a fourth was alive after a brief interval but with other metastases discovered at operation; in the fifth, a metastatic hypernephroma involving the sternum was mistakenly diagnosed as a primary bone tumor, the sternum was excised, and the patient subsequently died with multiple lung deposits.

A number of cases from the literature are also reviewed. There were several postoperative deaths but a number of patients survived for varying periods. One was alive thirteen years after nephrectomy for the primary tumor, followed fifteen months later by subtotal lobectomy for a solitary metastasis.

Among the points stressed are the low incidence of proved single metastatic tumors in the chest or, indeed, anywhere in the body; the impossibility of differentiating many benign from malignant chest tumors by roentgenology alone; the frequent difficulty of distinguishing between primary tumors and solitary metas-

tases on the basis of x-ray findings alone. It is concluded that the many problems associated with solitary metastatic tumors of the chest remain unsolved and that methods of treatment are still in an experimental stage.

FREDERICK A. BAVENDAM, M.D.

On the Value of Planigraphy in Bronchial Cancer. J. Frimann-Dahl. *Acta radiol.* 27: 99-114, March 30, 1946.

Three methods are available for the roentgen localization and diagnosis of bronchial tumors, so-called air bronchography, oil bronchography, and planigraphy. The author presents a series of 56 cases in which planigraphy was done and a diagnosis of carcinoma was confirmed microscopically or was otherwise reasonably certain. Many of the patients were examined by the other methods also. Air bronchography was found to be of limited value, and oil bronchography has the disadvantage of being uncomfortable for the patient, as well as entailing danger of oil retention in the lungs, with the possible production of secondary atelectasis.

In 46 of the 56 cases, planigrams sufficed to localize the tumors. To obtain satisfactory roentgenograms, each patient was examined fluoroscopically and placed in the optimum position with the involved bronchus parallel to the selected plane for roentgenography, usually a frontal or oblique position but occasionally lateral. In those cases in which there was complete stenosis of a bronchus with an atelectatic wedge, diagnosis was easy. Tumors which presented themselves as a mass surrounding a bronchus and with some invasion of the wall were likewise identified by planigrams. The author believes that such complications as cavities and bronchiectasis are more easily demonstrated by planigraphy than by other methods. In general, the nearer the tumor is to the large bronchi the easier and more reliable is the planigraphic diagnosis.

Differential diagnosis includes benign tumors, foreign bodies, and lung abscess. In only three cases in this series did oil bronchography prove to be superior to planigraphy.

ELIZABETH A. CLARK, M.D.

Mass Miniature Radiography of Children. R. A. Reynolds. *Irish J. M. Sc.*, No. 244, April 1946, pp. 134-136.

The author believes that the application of mass miniature radiography is justified economically by its relatively low cost and the economic loss involved by each tuberculous patient who has to be supported during a long period of inactivity. The number of cases of active tuberculosis uncovered by this means among 897 school children from Cork and Dublin was 22, or 1.7 per cent, representing about 3 per cent of all those reacting positively to tuberculin.

The author notes that in one of the schools only the positive tuberculin reactors were examined, and from his findings it would seem to be more economical to limit the survey to such groups.

SYDNEY F. THOMAS, M.D.

Photoroentgenographic Results. A Comparison of the 4 X 5" and the 70 mm. Equipment in 1,713 Cases. Frederick Tice. *Am. Rev. Tuberc.* 53: 454-467, May 1946.

In order to determine the relative efficiency in tuberculosis survey work of the 4 X 5-inch and the 70-mm. film, the author and his associates conducted a compara-

tive survey in 1,713 cases. The results are presented in tabular form. The final studies led to the diagnosis of 37 cases of reinfection tuberculosis and 23 suspects. Of these, one was missed on the 70-mm. film, the only significant variation in the entire series.

Since it is nearly as accurate, the 70-mm. film would seem to have its place in large industrial surveys, military screening, progressive surveys in metropolitan centers, mental hospitals, and other institutional examinations.

L. W. PAUL, M.D.

Parapneumonic Bullous Emphysema in Infants. Ada Middelhoven. *Acta paediat.* 33: 119-128, 1946.

The author reports a case of bullous emphysema in a six-month-old boy. The condition is that described in 20 cases by Caffey as "regional obstructive pulmonary emphysema in infants and children" (*Am. J. Dis. Child.* 60: 586, 1940). The patient was dyspneic but otherwise only moderately ill. The findings on the x-ray films were, as is usual in these cases, out of all proportion to the degree of illness.

This condition has frequently been seen in infantile pneumonia. It has most often been confused with congenital cystic disease, lung abscess, and tuberculosis. The transient nature and constantly changing appearance of the bullae establish the diagnosis. Many will balloon up and deflate in a short period of time without any treatment other than supportive measures. The general opinion is that these cavities originate by a check-valve mechanism. Thickened mucous membrane, plugs of secretion, or scar formation cause a partial obstruction of the afferent bronchioles.

Illustrations are included showing the course of the lesion from its discovery until its disappearance.

[A case similar to the one recorded here was presented by the abstractor at the film-reading session of the Radiological Society of North America, on Dec. 1, 1946.]

STANLEY H. MACHT, M.D.

Transitory Pulmonary Infiltrations (Loeffler's Syndrome) in Rabbits. Peter A. Herbut and Frank R. Kinsey. *Arch. Path.* 41: 489-502, May 1946.

Loeffler's syndrome as observed in man was duplicated in rabbits by giving sensitized animals single or multiple intratracheal instillations of horse serum. Clinically the animals presented only slight disturbances. Roentgenography revealed transitory pulmonic infiltrations that cleared in from seven to thirteen days. On pathologic examination there were congestion, edema, and eosinophilic infiltration of the submucosa of the trachea and the bronchi; in the lung parenchyma there were congestion, edema, atelectasis, emphysema, and an eosinophilic pneumonia. Eosinophils were found in the tracheal secretions. The syndrome in rabbits differed from that usually seen in man in that (1) there was no eosinophilia and (2) the pulmonic shadows were not migratory. It is concluded that Loeffler's syndrome is an allergic inflammation of the lungs and that one route by which the allergen invades is that of inhalation.

Pulmonary Hydatid Disease: The Sign of the Camalote. James A. Jenkins. *Australian & New Zealand J. Surg.* 15: 296-298, April 1946.

South American surgeons, who have the opportunity of seeing a considerable number of cases of hydatid disease, have described a rather unusual sign which they

consider pathognomonic of hydatid lung cyst. This is the "sign of the camalote," so-called from its resemblance to a South American river plant bearing that name, not unlike a water lily.

As a result of erosion by an impinging cyst, a bronchus may eventually communicate with the potential space between the adventitious pericyst and the hydatid membrane. When sufficient air enters this space to cause complete separation and collapse of the hydatid membrane, with loss of much of the hydatid fluid through the bronchial fistula, a characteristic wavy mass of parasitic membrane lies within the air-filled pericyst, moving within the cyst on a small amount of remaining fluid. It is this appearance that is known radiologically as "the sign of the camalote." The author, in a report from New Zealand, describes a case in a child of six in which this sign was present.

[An excellent diagram showing this appearance is included in a report by Evans in *Radiology* 40: 365, 1943.—Ed.]

Bronchopulmonary Geotrichosis. Ralph H. Kuntz, Robert C. Pendergrass and Joseph H. Schubert. *Am. J. M. Sc.* 211: 583-589, May 1946.

Geotrichum resembles *Blastomyces dermatitidis* and *Coccidioides immitis* in many respects. The genus is quite large, the species being mostly saprophytic on earth and decaying organic matter. Infection by *Geotrichum* is rare.

The authors present the case history of a young colored man who had been stationed in western Texas for one month. He complained of chest pains, which disappeared in a few days. About three months later he had a recurrence of the chest pain, accompanied by night sweats, weakness, cough productive of small amounts of mucoid sputum, and weight loss. A friction rub was heard over the chest. Roentgenographically, diffuse mottling was demonstrable in both lungs. The symptoms were thought to be due to coccidioidomycosis or pulmonary metastases, but all laboratory studies were negative except that *Geotrichum* was found on culture. Under sodium iodide therapy, the infiltrations cleared completely in three months.

While it is true that yeasts may contaminate sputum specimens in the laboratory, and be present in the respiratory tract as non-pathogenic organisms, it is also recognized that they may act as both primary and, more often, as secondary invaders. It is highly important that repeated examinations be made for tubercle bacilli before tuberculosis is excluded. Peterson (*Radiology* 43: 14, 1944) stated that "any lesion having the appearance of tuberculosis, in which no tubercle bacilli can be found, should be studied carefully to rule out a fungus infection. In patients in whom no definite organism can be isolated, a therapeutic test with iodine may be instituted and the final diagnosis based on the response."

Geotrichum was isolated from two other cases of chronic respiratory disease, but in these there was no evidence of pulmonary infiltration roentgenographically.

BENJAMIN COLEMAN, M.D.

Pulmonary Acariasis. Its Relationship to the Eosinophil Lung and Loeffler's Syndrome. A. van der Sar. *Am. Rev. Tuberc.* 53: 440-446, May 1946.

The author reports a study of 8 cases of the syndrome known as "tropical eosinophilia." Clinically the pa-

tients had attacks of asthmatic bronchitis or of bronchitis without asthma. The peripheral eosinophil count ranged up to 80 per cent. Mites were present in the sputum in all 8 cases. In one, the adult form of *Tyroglyphus* was found. In 6 others the mite was believed to be in a hypopal stage, and in one the mite had not been identified.

One patient showed no roentgenographic changes in the lungs; 2 revealed transient infiltrates similar to those seen in Löffler's syndrome. In the remaining 5 the changes were typical for "eosinophilic lung," i.e., enlarged hilar markings and a fine mottling with ill defined spots scattered throughout the lung. After treatment with mafarside or carbason the symptoms disappeared and the x-ray findings cleared.

L. W. PAUL, M.D.

Thoracic Gastric Cyst. Anibal Roberto Valle and M. Lawrence White, Jr. *Ann. Surg.* 123: 377-383, March 1946.

A case of thoracic gastric cyst of entodermal origin in a 22-month-old girl is presented. Symptoms of a "cold" appeared shortly after birth and persisted until the age of four months, when the patient began to have severe paroxysms of coughing accompanied by cyanosis. A diagnosis of "membranous croup" was made by the family physician. A chest film at that time is said to have revealed pneumonia. A wet paroxysmal cough, fever, hoarseness, and episodes of cyanosis persisted despite several courses of sulfonamides. Serial chest films showed what was interpreted as a chronic pneumonia on the right side which, in view of the prolonged illness, was finally diagnosed by the family physician as a lipid pneumonia. At the age of seven months the patient coughed up a large quantity of bright blood. Clubbing of the fingers was noticed at this time. From then, until the child was seen by the authors, seven severe pulmonary hemorrhages occurred, each requiring hospitalization and multiple transfusions. Only in recent weeks had the persistently wet cough resulted in the expectoration of grossly purulent sputum.

The patient was poorly developed, undernourished, and obviously chronically ill, weighing only 18 pounds. Marked clubbing of the fingers and toes was present. The chest had an enlarged anteroposterior diameter, suggesting emphysema. Auscultation elicited coarse moist râles bilaterally from apex to base, particularly on the right.

Roentgenography of the chest revealed a marked mottled infiltration particularly in the right lower lobe with some involvement also in the middle and upper lobes. There was a dense elliptical shadow in the right hilar region which was thought to be an enlarged hilar node. No evidence of cavitation was seen. The left lung was essentially clear. A review of the old films disclosed similar hilar adenopathy and infiltration in the right lung.

Bronchograms showed generalized bronchiectasis of the right lung and a large cavity in the posteromesial portion of the right lower lobe. The oil flowed readily into this cavity through a large bronchial communication.

A diagnosis of bronchiectasis with an infected bronchial cyst was made. Surgical extirpation of the diseased lung was decided upon in spite of the patient's poor general condition. Just above the diaphragm in the lower lobe was a dense mass, apparently inflam-

matory, about the size of an egg. This mass was presumed to represent the cystic area seen roentgenographically. This portion of the lung was separated from the parietal pleura, but in so doing the cystic cavity was broken into and the peripheral portion of the cavity wall, densely attached to the diaphragm and posterior gutter, remained behind as the mobilization of the lung was completed. The lung itself was obviously infected, with areas of dense inflammatory infiltration from apex to base. The patient died during the operation. Further exploration revealed that complete excision of the cyst wall would have been an impossible surgical feat. Closer examination of the lining of the cyst suggested typical gastric mucosa with rugae, and the true diagnosis was first suspected at this time. Remnants of the cyst were found to extend down through the diaphragm, in intimate contact with the inferior vena cava, the bodies of the vertebrae, and the esophagus. The cyst ended blindly about 5 cm. below the diaphragm, without anatomic continuity with either esophagus or stomach.

Radiotherapeutic Test in the Differential Diagnosis of Mediastinal Pathology. Simeon T. Cantril and Franz Buschke, Editors, Radiation Therapy Conference. *West. J. Surg.* 54: 166-169, April 1946.

The response of a mediastinal lesion to x-ray therapy has long been used as an important adjunct in differential diagnosis. In the analysis of the results of such radiotherapeutic tests, it must be realized that lesions that do respond to radiation may vary widely in their degree of radiosensitivity and in the rapidity of their response. The authors give two examples which emphasize this point.

(1) A man of 36 had had a right oleothorax for tuberculosis for eight years. A few months before admission he experienced a choking sensation, which rapidly became worse. He was observed for several months in a sanatorium and the dyspnea became more severe during that time. At the time the authors first saw him, he had marked cyanosis of the face, enlargement of the superficial skin vessels, extreme dyspnea and a normal temperature. A chest film showed displacement of the heart and mediastinum to the left, with a fluid level in the right chest field. There was a large mediastinal mass measuring 17 cm. in diameter. Since the diagnosis was equivocal and since the possibility of a mediastinal lymphoblastoma without relationship to the previous oleothorax had to be excluded, a radiotherapeutic test was given. On the morning after the first treatment (85 r on the skin, with 200 kv. and 2 mm. copper filtration) the patient could breathe easier and after four treatments (a total of 385 r) he appeared practically normal. A film made four days after the first application of the rays showed complete disappearance of the mediastinal mass. Because of the rapid and complete response, it was believed that the lesion was a preleukemic mediastinal lymphoblastoma. The patient was discharged in January 1941 in excellent condition, having received a total of 535 r to the mediastinum. Within two months all the classical signs of lymphatic leukemia were present. Autopsy showed widespread lymphomatous infiltration.

The second patient was a 26-year-old woman who was admitted in February 1942. In the fall of 1941 a diagnosis of Hodgkin's disease was made on clinical

grounds, but this diagnosis was rejected because a mediastinal mass failed to respond to a therapeutic test. The total dose given was around 1,000 r (200 kv., 0.5 mm. copper filtration) and the observation time was three weeks. When the patient was seen in 1942, her main complaints were coughing and choking spells. A lymph node removed from the right supraclavicular fossa showed definite early Hodgkin's disease. A chest film in January 1942 revealed a mass measuring 8 cm. in diameter in the upper anterior mediastinum. Between Feb. 10 and March 9, 1942, this patient was given 5,300 r measured on the skin (200 kv., 2.0 mm. copper filtration), equally divided between anterior and posterior mediastinal fields. During the first treatment week there was increase in dyspnea with development of a mild edema of the neck. Treatment was continued, however, and clinical improvement was noted after twelve treatment days. It was only after 36 days that real diminution of the mediastinal mass could be determined roentgenographically. Radiation therapy was continued until the total dose over two fields was 7,100 r in 43 days. A film obtained Aug. 19, showed an entirely normal chest with complete absorption of the mediastinal tumor. Repeated examinations since that time have shown no recurrence.

As these two cases show, certain types of Hodgkin's disease and other lymphoblastomatous lesions require considerably more radiation and considerably longer observation periods than is generally supposed. In some of these cases the required dosage may very closely approach a cancer-sterilizing dose.

BERNARD S. KALAYJIAN, M.D.

Longevity with Ventricular Aneurysm. Case Report with Survival of Fifteen Years. Sidney L. Penner and Michael Peters. *New England J. Med.* **234**: 523-526, April 18, 1946.

The prevailing opinion about cardiac aneurysm is that the life expectancy is rather short. The present report concerns a man who had coronary disease in 1929 at the age of forty-three and suffered several attacks of cardiac pain in the following four years. In 1945 another attack of left shoulder pain with radiation down the left arm occurred and a chest film showed slight cardiac enlargement. There was a curvilinear band of calcification over the left ventricular region, which at fluoroscopy was seen to be in the outer surface of an old outpouching of the anterior surface of the left ventricle. In the latter part of 1946, this patient is still well and active.

The following changes are most frequently found in cardiac aneurysm: enlargement of the left ventricle with deformity of the contour, a localized protuberance, absence of pulsation, evidence of adhesions and calcification of the aneurysmal wall or interventricular clot.

Since this patient had several long periods of bed rest, it is believed that this is an important feature in the therapeutic handling of coronary heart disease.

JOHN B. McANENY, M.D.

Movements of the Mitro-Aortic Ring Recorded Simultaneously by Cine-roentgenography and Electrocardiography. Bengt S. Holmgren. *Acta radiol.* **27**: 171-176, March 30, 1946. (In English.)

Previous studies of the use of cine-roentgenography to trace the movements of intracardiac calci-

fications in the mitro-aortic ring describe the motion as roughly triangular in its course. The author reports two cases in which a similar study was made, synchronized with electrocardiography. The movement in each of these cases was in a straight line. By correlating the electrocardiographic findings with the observed motion of the calcifications, it was found that the highest point of excursion occurred in presystole. When the ventricles began to contract at R of the QRS-complex, the annulus fibrosus was displaced toward the cardiac apex, and motion stopped at the end of ventricular contraction, corresponding to the point just after the T wave.

ELIZABETH A. CLARK, M.D.

Roentgenologic Changes Observed in Tropical Diseases. Harry M. Weber. *Am. J. M. Sc.* **211**: 629-636, May 1946.

In this "Progress of Medical Science" paper the author reviews the recent literature on the roentgenologic aspects of tropical disease and points out the necessity that "roentgenologists and their consultants in internal medicine should be prepared . . . to think in terms of tropical diseases and their late sequelae." Most of the material cited has appeared in *RADIOLOGY* in the original or abstract form.

THE DIGESTIVE SYSTEM

Radiological Diagnosis of Certain Diseases of the Lower Esophagus. J. W. McKay. *S. Clin. North America* **26**: 306-318, April 1946.

The author points out the importance of radiologic examination of the esophagus in the presence of thoracic pain. He precedes his discussion of various esophageal conditions by a description of the radiologic technic and sections on anatomy and physiology which should be read and re-read for their clear-cut, dynamic picture of the esophagus in action.

Though esophageal *hiatus hernia* is hardly to be classed as a disease of the esophagus, it is considered here because of its resemblance to the phrenic ampulla. An esophagus of normal length may enter the stomach below the diaphragm and the gastric hernia may be only partial, or the lower end of the esophagus may also be elevated above the diaphragm. In either case, the diagnosis is relatively easy because of the large size of the hernia and the presence of gastric rugae in the thorax. The esophagus enters the herniated cardia from the medial side, thus distinguishing true herniation from a congenitally short esophagus with thoracic stomach. The position of the esophagus is best determined with the patient supine, with the left shoulder rotated toward the fluoroscopic screen. Marked kinking is not seen. The type of hernia designated as *hiatus insufficiency* is more difficult to differentiate from the phrenic ampulla. The Valsalva maneuver, which is useful in demonstrating the ampulla, also aids in demonstrating, or perhaps producing, protrusion of the cardiac end of the stomach in hiatus insufficiency. The difference in the mucosal pattern of the stomach and esophagus may be of help in diagnosis.

The x-ray picture in long-standing *cardiospasm* is characteristic. The esophagus dilates to a marked degree and eventually becomes elongated and tortuous. As it increases in size, it produces widening of the mediastinal shadow to the right. The lower end of the

dilated esophagus is usually smooth, narrow, and conical in shape, though the smooth appearance may be altered by a complicating esophagitis and ulceration above the obstruction. Conditions to be differentiated are benign stricture and carcinoma.

Esophagitis is described as showing spastic contractions, stenosis, and distortion of the mucosal folds.

Carcinoma of the esophagus may be of the stenosing, infiltrating or scirrhus type, producing a circular stenosis; of the medullary type, which ulcerates early and produces an irregular filling defect in the barium-filled esophagus; or of the polypoid form, which is rarely recognized radiologically.

Varices may be demonstrated by the Valsalva test.

SYDNEY F. THOMAS, M.D.

Diagnosis and Differential Diagnosis of the Phrenic Ampulla, the Short Esophagus with Partial Thoracic Stomach, and Hernia of the Esophageal Hiatus. R. P. O'Bannon. *South. M. J.* 39: 320-325, April 1946.

The recognition of the phrenic ampulla, the congenitally short esophagus, and true hernia through the esophageal hiatus is essentially a radiological problem. There is no group of clinical symptoms which can be regarded as characteristic of these conditions.

The normal esophagus is considered to be a hollow muscular tube of uniform transverse diameter throughout its extent, and so it appears on the roentgen film. It ends in a sort of flat, conical constriction at the cardiac orifice of the stomach. The rugae are quite characteristic and are readily demonstrated with the barium meal, appearing as practically continuous long thin lines of barium, usually unbranched. The phrenic ampulla appears as a sacular dilatation of the lower end of the esophagus, sometimes small, sometimes more prominent, with a slight band-like constriction at its upper margin. Its recognition is of importance only that it may be differentiated from other conditions, as it has no pathological significance. It is exaggerated by rapid swallowing of the barium mixture or by increase of intra-abdominal pressure, as by the Valsalva experiment. It disappears partially or completely on completion of the swallowing act. The normal rugal markings of the esophagus may be readily traced through the phrenic ampulla.

The congenitally short esophagus with partial thoracic stomach, when completely filled with barium, like the phrenic ampulla, presents a bulbous dilatation with a band-like constriction at its upper margin marking the termination of the esophagus. Usually there is a much less prominent constriction at the diaphragm. With the patient lying on the back and turned moderately to the left, the filled bulbous portion of the stomach may be observed over a long period of time. It rapidly empties on assumption of the erect position. Fluoroscopically, the esophagus may be seen to enter directly the apex of the bulbous dilatation. On turning the patient on the abdomen, gravity allows the meal to flow into the pyloric end of the stomach, with partial emptying of the fundus. The coarse gastric rugae, quite different from the linear rugae of the esophagus, can then be visualized. Furthermore, the gas bubble floats into the fundus and the gas shadow more clearly outlines the thoracic portion of the stomach. Confirmation of the diagnosis may be obtained by esophagoscopy examination.

In the presence of true hiatus hernia, if the patient is placed on his back and turned moderately to the left, the

first swallow of barium will be seen to descend through the entire esophagus and enter the abdomen and then appear in the herniated portion of the stomach. By rotating the patient, a position may be found where the completely filled esophagus can be demonstrated as it passes around the herniated portion of the stomach and enters the fundus. The lower portion of the esophagus may be displaced medially, forming a hook-like curve about the hernia. If the hernia produces pressure on the lower end of the esophagus, it may be moderately dilated. When the patient is turned on the abdomen, permitting the barium to flow toward the pyloric end of the stomach, the characteristic appearance of the gastric rugae will be shown in the herniated portion. If barium clings to the walls of the lower part of the esophagus, the rugal pattern of the esophagus may be demonstrable, passing around or across the herniated portion of the stomach according to the position of the patient.

BERNARD S. KALAYJIAN, M.D.

Atresia Oesophagi Congenita with Oesophago-Tracheal Fistula. P. M. Kjelland. *Acta paediat.* 33: 151-157, 1946.

A case is reported of congenital esophageal atresia at the level of the fourth thoracic vertebra associated with an esophagotracheal fistula between the bifurcation of the trachea and the lower portion of the esophagus. The infant was born at full term. It vomited from birth but lived for five days. Roentgen examination with barium sulfate demonstrated the blind pouch of the upper esophagus. It also showed air in the stomach and intestines. No other congenital anomalies were found. Illustrations of the roentgen findings and autopsy specimen are included. Theories of the development of this anomaly are presented.

PAUL W. ROMAN, M.D.

Chronic Ulcerative Oesophagitis with Report of a Case of Ulcer in Oesophageal Varices. George Steiner. *Brit. J. Radiol.* 19: 145-152, April 1946.

Since a circumscribed crater niche is seldom demonstrable in the esophagus, indirect signs are of importance for the diagnosis of esophageal ulceration. Among these are delay in the passage of barium, spasm, stenosis, dilatation, abnormal peristalsis, and hypertrophic changes in the mucosa, all of which, however, may occur in other conditions and serve only to indicate the esophagus as the site of the lesion. Other indirect signs, indicative of chronic inflammation or swelling, are irregularity of rugal alignment, persistent coarsening of or granular thickening along the folds, loss of pliability or even rigidity of the rugae, and poor definition or loss of the mucosal pattern. There may also be evidence of peri-esophageal adhesions within or above the hiatus.

Three conditions—exclusive of foreign bodies, corrosive agents, specific diseases, and tumors—predispose to the development of chronic ulcerative esophagitis. These are: (1) the presence of gastric juice from ectopic deposits of gastric mucosa or as a result of regurgitation through an unduly patent cardia or in association with a hiatal hernia; (2) debility due to systemic disease, causing a generally diminished tissue resistance; (3) local factors such as hiatal hernia, irritation from a postoperative suction tube, or esophageal varices.

Four cases are recorded. In one of these ulceration was associated with varices presumably due to splenic vein thrombosis.

SYDNEY J. HAWLEY, M.D.

Partial Transposition of the Upper Abdominal Viscera. A. P. Guttman and I. Maclaren Thompson. *Canad. M. A. J.* 54: 486-487, May 1946.

The authors point out that apart from extensive visceral transposition, dextrogastrica is exceedingly rare. A case is reported in which roentgenologic studies showed the stomach transposed to the right side of the abdomen and the duodenum to the left. The colon was in the normal position but the descending colon was nearer the median plane than usual. The gallbladder was on the left side, and the heart in normal position. The liver appeared to be on the left; the tail of the pancreas and the spleen were presumably on the right side.

BERT H. MALONE, M.D.

Emphysematous Gastritis. H. Stephen Weens. *Am. J. Roentgenol.* 55: 588-593, May 1946.

Emphysematous gastritis is an inflammatory process of the stomach caused by a gas-forming organism. It was first recognized by Fraenkel in 1889 (Virchow's *Arch. f. path. Anat.* 118: 526-535, 1889). Weens reports a case in a man, aged thirty-seven, following the ingestion of concentrated hydrochloric acid. Extensive gas formation in the gastric wall was demonstrated roentgenologically for a period of approximately four weeks. The infection was followed by extensive scar formation which resulted in complete obstruction of the midportion of the stomach and necessitated two gastrotomies. *B. proteus* was cultured from the stomach contents and *A. aerogenes* was grown from a blood culture. A subphrenic abscess and multiple liver abscesses followed the second gastrotomy, and the patient died.

The roentgen diagnosis of emphysematous gastritis depends upon the demonstration of gas formation in the wall of the stomach. If the stomach contains fluid, the gas-containing wall will show sufficient contrast to be recognized as a zone of decreased density. On examination in the recumbent and upright positions, the gas cysts will maintain constant position, regardless of posture. Oral contrast media will permit exact localization of the visceral lumen. In the differential diagnosis pneumatosis intestinalis cystoides must be ruled out. This is characterized by the formation of gas vesicles in the intestinal wall. It has rarely been observed in the stomach. It is usually an incidental finding in association with chronic gastric and duodenal ulcer and does not produce clinical symptoms.

CLARENCE E. WEAVER, M.D.

Decrease in Size of Niche in Cancer of the Stomach. Hans Hellmer. *Acta radiol.* 27: 153-170, March 30, 1946. (In German.)

Four cases are reported in which roentgen examination of the stomach revealed a definite decrease in the size of a niche. In each instance, the niche was found at operation to be of cancerous origin. Decrease in size of a niche following internal treatment cannot, therefore, be used in the differential diagnosis between gastric ulcer and carcinoma of the stomach.

F. ELLINGER, M.D.

Congenital Duodenal Stenosis. Report of a Case. C. L. Tucker. *New Zealand M. J.* 45: 118-120, April 1946.

A case of congenital duodenal stenosis, which remained undiagnosed until the patient was six years of

age, is presented. At the age of eighteen months the child began having intermittent vomiting attacks lasting from one to three weeks, followed by freedom from symptoms for three or four months; he was hospitalized on several occasions, but no x-ray investigations were carried out. When roentgen studies were eventually made, they showed that the stomach was not unduly dilated; the pylorus and duodenal cap filled, but there was dilatation of the descending and proximal transverse loops of the duodenum, with pooling of the barium in the dilated portion. The condition was treated successfully by anterior duodenojejunostomy (because of a distended and congested mass of veins in the mesocolon, it was impossible to do a posterior anastomosis). This case shows the necessity for careful roentgen examination in children with a history of periodic vomiting attacks.

Acute Gastroduodenal Obstruction (Dilatation). William C. Beck. *Arch. Surg.* 52: 538-546, May 1946.

Acute gastroduodenal dilatation is usually due to an obstruction of the duodenum by compression between the superior mesenteric artery and the vertebral column and aorta. It usually occurs in a debilitated or emaciated patient who is forced to lie on his back. Judging from reports, it is a fairly common condition. The author saw 4 cases in wounded soldiers in seven months. The most prominent symptom is vomiting, copious in amount and associated with nausea. Large amounts of fluid may be obtained from the stomach by aspiration. Periumbilical pain is usually present.

The diagnosis is made on the roentgenogram (scout film), which shows pronounced dilatation of the first and second portions of the duodenum. A lateral roentgenogram of the abdomen demonstrates the posterior position of the air in the duodenum, at the point of blockage, and is a conclusive test. The author recommends the recumbent position and believes a search for fluid levels is useless and confusing.

Treatment is aimed at keeping the stomach empty, relieving the obstruction, and correcting the electrolytic and nutritional deficiency. The second point is accomplished by decompression and positioning (the knee-chest position is especially useful). Operation is rarely indicated. The prognosis is good, but before discharge roentgenologic study should be undertaken to determine whether a chronic duodenal ileus is still present.

LEWIS G. JACOBS, M.D.

Foreign Bodies in the Duodenal Cap. Giuseppe de Andraisi. *Radiol. med. (Milan)* 32: 108-121, April 1946.

De Andraisi describes several cases of foreign bodies in the duodenal cap and in the duodenal loop, which were ingested by malingering Italian soldiers attempting to confuse radiological examination. Good roentgenograms show the appearance of these foreign bodies, which were ingested immediately prior to the examination and were mostly of vegetable nature.

CESARE GIANTURCO, M.D.

Diverticula of the Jejunum—with Report of Two Cases. Carrington Williams and John B. Walker. *Virginia M. Monthly* 73: 212-215, May 1946.

Three hundred cases of diverticula of the jejunum have been reported, to which the authors add two. They point out that the presence of diverticula does not

result in abnormal function, so that there is no manifestation of their presence until some complication develops. When the diverticula become acutely inflamed, symptoms of acute abdominal inflammation develop, and perforation may ensue, leading to local or general peritonitis. In chronic cases, if the inflammation results in considerable infiltration of the adjacent bowel, there may be signs and symptoms of partial obstruction. If diverticula become filled with intestinal contents and empty poorly, vague pain, flatulence, and intestinal disturbances occur. There is thus no characteristic clinical picture, and the diagnosis is dependent upon x-ray demonstration of the diverticulum. This examination is contraindicated, however, in the presence of acute inflammation and is not always satisfactory in chronic cases.

The first of the authors' patients gave a history of chronic gastro-intestinal complaints, and a jejunal diverticulum was demonstrated roentgenographically. At operation, two diverticula were found, each with a small opening into the jejunum on the antimesenteric border. Both were successfully excised, and relief of symptoms followed.

The second patient was acutely ill, with symptoms leading to a preoperative diagnosis of ovarian cyst strangulated by a twisted pedicle. This diagnosis was confirmed at operation, and further exploration revealed an inflammatory mass above and to the left of the navel. This was found to have resulted from a perforation of a diverticulum which was well walled off by adjacent loops of bowel. A large number of other diverticula were seen along the mesenteric border in a segment of jejunum about 24 inches in length. The perforated diverticulum was excised and the small defect in the bowel wall closed with a purse-string suture. The patient made a satisfactory recovery and six weeks later the segment containing the remaining diverticula was excised and an end-to-end anastomosis was done. Recovery was again uneventful, and the patient has remained well since.

These cases represent the congenital type of diverticula, since all the layers of the bowel were present in their walls.

J. E. WHITELEATHER, M.D.

Cystic Fibrosis of the Pancreas. T. B. Merner, J. F. Bosma, and A. J. Moss. *Minnesota Med.* 29: 429-436, May 1946.

Clinically, cases of cystic fibrosis of the pancreas closely resemble the more familiar celiac disease. Both conditions are characterized by bulky stools, abdominal enlargement, and signs of nutritional deficiency. Cystic fibrosis of the pancreas, however, is actually a generalized disorder, one of the striking manifestations of which is chronic disease of the respiratory tract.

In a certain percentage of cases, death occurs within a few days of birth and the intestine is found to be obstructed by an unusually viscid meconium. In a case of this type reported here, persistent respiratory difficulty followed laparotomy and death ensued on the fourth day of life. Autopsy showed increased amounts of thick mucus in the bronchi and bronchioles and characteristic changes in the pancreas—atrophy of the exocrine parenchyma and dilatation of the ducts, which were filled with inspissated secretion. Children who survive longer are peculiarly susceptible to chronic respiratory infection, with progressive secondary emphysema and bronchiectasis. The accumulation of the typical viscid bronchial secretions may cause episodes of

dyspnea and wheezing, and death is commonly due to bronchopneumonia. Retardation of physical growth is a secondary feature leading to dwarfism in the older patients.

The etiology remains obscure. The authors find Farber's theory (*Arch. Path.* 37: 238, 1944) most acceptable. According to this view, the mucous secretions of these patients are characteristically viscid, causing mechanical obstructions which lead to the cystic changes in the pancreas and play an important role in the development of pneumonia. There seems to be a familial tendency in that several siblings are likely to be affected.

The single laboratory test which provides a valid basis for the diagnosis of cystic fibrosis of the pancreas in the living patient is analysis of the pancreatic juice as obtained by duodenal aspiration. Even in cases with minimal disease there is usually complete absence of trypsin. Under the heading of "Roentgenologic Findings," mention is made of Golden's "segmentation" effect in the small intestine, thickening of the mucosal folds with elimination of the fine mucosal pattern, and hypomotility, but these findings are not specific. The pulmonary changes are said to be quite characteristic. The disease is diffuse, is of chronic nature, and appears to be progressive. Mottled densities are seen in both hilar regions, extending in streaked fashion into the peripheral areas of emphysema. The findings are sufficiently suggestive to be recognized in the chest roentgenogram, and other diagnostic procedures should then be carried out.

The greatest known age of survival with this disease is fourteen years.

The authors' observations are based on 8 cases, details of which are presented in tabular form.

Pancreatic Heterotopia. Review of the Literature and Report of 41 Authenticated Surgical Cases, of Which 25 Were Clinically Significant. Jorge J. de Castro Barbosa, Malcolm B. Dockerty, and John M. Waugh. *Surg., Gynec. & Obst.* 82: 527-542, May 1946.

Abnormally located masses of pancreatic tissue originate antenatally as a result of incomplete regression of the left ventral anlage, which normally atrophies, or of engrafting of portions of the rudimentary ducts on the gastric or intestinal wall or the mesentery; or it may be that lateral buds become pinched off when they penetrate the gut wall and are carried up or down by longitudinal growth.

Heterotopic pancreatic tissue is discovered in 0.6 to 5.6 per cent of routine necropsies and is found once in approximately every 500 operations on the upper abdomen. A review of the literature indicates that some 430 cases were recorded up to March 1944, and to these the authors add 41 authenticated cases from the Mayo Clinic and an equal number of cases unproved by histologic study. The ratio of males to females is 3 to 1.

In about 70 per cent of cases the heterotopic tissue is located in the stomach, duodenum, or jejunum. The ileum, spleen, biliary tract, mesentery, omentum, and various diverticula are less usual sites. The deposits are for the most part single, measuring 1 to 4 cm. in diameter. Grossly and microscopically, they resemble the pancreas. More than half are limited to the submucosa, but muscular coats and serosa may also be involved. Most show evidence of acinar function, and hyperinsulinism and hypoglycemia may result from an extrapancreatic adenoma.

The same pathological changes occur as in the pancreas itself, but malignant changes are more apt to take place than in the pancreas proper. Adjacent tissues may also show changes, such as ulceration of the mucosa, diverticulum formation, necrosis or hemorrhage.

In many of the cases the lesions are clinically important, the stomach and duodenum being the sites of involvement. Symptoms vary with location and are similar to those of other gastroduodenal lesions. Adenocarcinomas of the duodenum may originate in aberrant pancreatic tissue. Sixty-one per cent of the authors' authenticated cases were clinically significant.

In the stomach 50 per cent were diagnosed roentgenologically as benign tumors, 20 per cent as ulcers, and 20 per cent as malignant tumors. In the duodenum most were diagnosed as ulcers. At operation the differentiation from malignant growth may be impossible without frozen sections.

Treatment consists of excision, but frequently more radical operations are performed because of uncertainty as to the diagnosis. When found incidentally at operation, the heterotopic tissue should be removed.

J. L. BOYER, M.D.

Heterotopic Pancreatic Tissue in the Region of the Pyloric Orifice. A Radiological and Pathological Analysis of Five Cases of Clinically Suspected Peptic Ulcer in Which Only Pancreatic Rests Were Found. Theo. R. Waugh and E. W. Harding. *Gastroenterology* 6: 417-435, May 1946.

In a series of 800 stomachs removed by subtotal gastrectomy in several hospitals over a period of six years, the authors found 5 cases in which aberrant pancreatic tissue was the only apparent pathologic condition to account for symptoms. In 4 instances the tissue was located in or very near the pylorus; in the fifth, in the second portion of the duodenum. In none was there evidence of peptic ulcer at the time of operation.

A review of the literature and these 5 cases reveals a strikingly similar but not pathognomonic symptomatology. Often there is a rather long history of indefinite, gradually increasing abdominal pain, with slight tenderness in the epigastrium. Symptoms may or may not be relieved by food and alkalies. Loss of appetite, sour eructations, nausea, and vomiting are likely to bring the patient to the physician. Hemorrhage, with either hematemesis or the passing of blood in the stool, has occurred in several cases. In 2 of the 5 cases presented here, there was a history of hemorrhage from the upper alimentary tract. X-ray findings are equivocal. Although no ulceration was found in the surgical specimens, yet in 4 cases the pancreatic rest appeared to be responsible for some roentgenologic abnormality. In 2 cases adjacent spasm apparently caused focal deformity in the nature of an incisura to suggest ulceration. In none of the cases, however, was there an absolute and positive roentgen diagnosis of ulcer. The failure of a juxta-pyloric lesion, as seen roentgenologically, to respond to medical treatment must suggest the possibility of a pancreatic rest.

There is no doubt that pancreatic rests can remain asymptomatic, and there is some question as to the primary role they play in many of the cases. If they are congenital, the fact that the majority of patients have no digestive disturbance and do not come to operation until adult life has to be explained. From the cases reviewed, however, it is obvious that heterotopic pancre-

atic tissue in the region of the pylorus can produce serious consequences in several different ways. First, and probably the most important of these, is actual interference with the passage of the stomach contents through the pyloric canal when the mass protrudes as a polypoid excrescence into the lumen. Second, though there may be no actual stenosis, this tissue in the muscular wall can in all probability interfere with peristaltic activity. Third, a peptic ulcer may arise apparently from the discharge of pancreatic juice through a duct into its base. Fourth, even though an ulcer is not present, the possibility that the activity of the tissue or its excretion may cause functional disturbance has been raised and would have to be considered in one of the authors' cases. Finally, benign and malignant neoplasms may arise from such aberrant tissue. This condition should be borne in mind in patients suspected of having peptic ulcer, neoplasm, or cholecystitis, with atypical findings.

Calcified Gall Bladder. Albert Jutras and Marcel Longtin. *Canad. M. A. J.* 54: 434-437, May 1946.

Some gallbladders retain in their walls amounts of calcium and thus acquire unusual properties of roughness, color, and sound effect to percussion. In the diagnosis of these calcified gallbladders the roentgenologist plays the feature part, for he alone can demonstrate the lime infiltration without having to open the abdomen.

Kirklin, of the Mayo Clinic, found calcified gallbladder in only 4 of a series of 5,826 cholecystectomies, and the present writers have made the diagnosis only 4 times in more than 6,000 cholecystographies performed since 1948.

Calcified gallbladders are usually large and of the hydropic type; occasionally they may be small, retracted, and sclero-atrophic. On microscopic examination, the different coats of the normal organ are no longer recognizable. The mucosa is reduced to a few cellular traces, while the submucosa and muscularis are fused in one layer, greatly deprived of cells and invaded by hyaline substances, strongly acidophile, giving a cartilaginous aspect.

Cholecystography with iodine preparations is usually valueless, since the cystic canal is commonly obstructed and the mucosa always destroyed, rendering both penetration and concentration impossible. Moreover, the richness in calcium permits spontaneous visualization on the flat film. The picture, in the hydropic form, is scarcely mistakable. The shadow has the shape, size, and location of the viscus whether ovoid, piriform, or round. In typical cases, the calcium is distributed unevenly in a most distinctive form. The edge is dense and sharply defined, forming a shell 1 to 2 mm. thick. This peripheral rim is due to a greater absorption of radiations in their course through the lateral portions. The ring is rarely closed, usually remaining open in some part of its upper pole, thus suggesting that calcification extends from bottom to top. Within the opaque margin, the transparency is very irregular, the lime dispersion producing mottling or patches and giving at times a somewhat fish-scale-like aspect.

The sclero-atrophic type of calcified gallbladder is not easily differentiated. The general form of the viscus is less defined and the volume small. The incrustation is never intense, being unevenly distributed and causing streaky imprints.

HUGH A. O'NEILL, M.D.

THE SPLEEN

Roentgen Studies of the Spleen. J. M. Dell, Jr., and H. F. Klinefelter, Jr. *Am. J. M. Sc.* 211: 437-442, April 1946.

Because of differences in the tone of the abdominal muscles, variations in the costal angle, states of nutrition, and the height of the domes of the diaphragm, enlarged spleens may not be palpable, and palpable spleens need not be enlarged. An attempt was made to establish the roentgenographic normal by making postero-anterior exposures of the left upper quadrant.

There was considerable variation in the size of normal spleens in different individuals. Due to the oblique position of the spleen, the width of the roentgen shadow is a combination of the breadth and the thickness. While it is always possible to measure the width, it is rarely possible to measure the entire length of the spleen. In those cases where the upper pole can be visualized, there is no constant relationship of the position of the spleen to the diaphragm. The greatest width, and the density of the spleen as compared with the lower half of the kidney, were used as criteria. When the complete contours of the spleen and the left kidney could be demonstrated, any spleen which was more than 85 per cent of the size of the kidney was considered enlarged. This figure was used because of the magnification of the kidney in the projection utilized.

The following criteria were established: the spleen is not enlarged if it is (1) not visualized, (2) is less than 5 cm. in width, (3) is less than 85 per cent of the size of the kidney. The spleen is enlarged if it is (1) more than 6 cm. in width, (2) more than 85 per cent of the size of the kidney.

No changes were noted in the splenic size in 8 cases studied to determine the effect of food, rest, and moderate activity. In 4 of 6 persons there was a marked decrease in the size of the splenic shadow after administration of adrenalin. BENJAMIN COPELAND, M.D.

ABDOMINAL ABSCESS

Roentgenologic Diagnosis of Abdominal Abscesses. H. Stephen Weens. *J. M. A. Georgia* 35: 142-145, May 1946.

Roentgen examination of the abdomen is of great assistance in the diagnosis and localization of intraperitoneal and retroperitoneal abscesses. Even without the use of a contrast medium, fluoroscopy and roentgenography frequently give valuable information on the motility and position of the diaphragm, the distribution and displacement of intestinal gas, the structure of the abdominal wall, and the presence of bacterial gas. The author describes the roentgen findings in subphrenic, intraperitoneal, and retroperitoneal abscesses and those occurring in the abdominal wall and within intraperitoneal and retroperitoneal organs. In this connection, see Weens' paper "Gas Formation in Abdominal Abscesses" in *RADIOLOGY* 47: 107, 1946.

THE MUSCULOSKELETAL SYSTEM

Dyschondroplasia. Isidore Cohn. *Ann. Surg.* 123: 673-686, April 1946.

Ten cases of dyschondroplasia are reported, bringing out the general and familial character of this condition. The author's observations are based on a study of cases

over a twenty-five-year period. In one family there was evidence of the condition in three generations; in another in two generations. Suggestive evidence of the disease in at least six or eight generations was obtained in one instance. The author published an earlier report on this same subject in *RADIOLOGY* (18: 592, 1932).

Metastatic Osteomyelitis Secondary to Tropical Ulcer. Margaret N. Shepherd. *Brit. J. Surg.* 33: 352-357, April 1946.

Of 98 Gurkha soldiers treated in a military hospital for tropical ulcers, 11 had metastatic inflammatory lesions in one or more long bones remote from the site of the ulcer. The fact that the cortex of the diaphysis was involved, with spontaneous cure, makes this a distinctive form of osteomyelitis. The ulcers frequently reached the final stage of epithelialization in about four weeks, but in some cases the earlier stage of liquefying gangrene persisted for six to eight weeks. This long-standing type often showed evidence of underlying bone reaction and sometimes bone necrosis with separation and discharge of sequestra, but it is only with the remote bone lesions that the present paper is concerned.

Eleven cases are reported in detail. In 10 of the cases the ulcer was clean and healing at the time of onset of the bone disease. The first symptom was local pain, mild in most instances, and tenderness. Four cases ran an afebrile course; one patient had marked fever for five weeks; and in the others there was mild or moderate fever for varying periods. With a single exception, constitutional symptoms were mild, and there was no reddening of the skin or inflammatory edema locally. In no case was sequestrum and sinus formation suggested clinically. The average time required for complete clinical healing was twelve weeks.

Radiologically, the first change was a decalcification in the cortex of the diaphysis of a long bone. Then followed linear periosteal new bone deposit, the new bone having a fluffy or woolly appearance, with a crenated outline. In some cases healing occurred by deposition of calcium salts in the new bone. In other cases changes indicative of osteomyelitis appeared before healing took place.

In 6 cases the bone lesion developed in a contralateral long bone. In 3 additional cases, the lesions were multiple and occurred on both sides. The bones involved, in order of frequency, were the tibia, femur, fibula, radius, and clavicle. The author has since seen 2 cases in which the shaft of the humerus was involved; and so far, the only long bones which have not been affected are the ulna and ribs. The ulcer sites in all the cases were on the leg, anywhere between the knee and the ankle.

MAX CLIMAN, M.D.

Osteomyelitis Radiographically Resembling Sarcoma. James F. Brailsford. *Lancet* 1: 498-499, April 6, 1946.

A six-year-old girl, with a fracture and roentgen changes in the upper half of the humerus suggesting an inflammatory focus, but with multiple rounded secondary areas in the lungs, was thought to have a general sarcomatosis. No biopsy was performed. In view of the hopelessness of any operative procedure and on the chance that the secondary lesions were inflammatory, sulfathiazole was given over a period of five weeks. A roentgenogram taken at the end of that time showed further disintegration of the upper half of the humerus

and progressive development of the multiple rounded lesions scattered throughout the lungs. After another month the patient began to show signs of improvement, and a roentgenogram taken six months after the original films showed that the bone lesion had resolved and the pulmonary lesions had disappeared. This result had been maintained up to the time of the report.

The absolute cure is phenomenal and quite distinctive from the results of any treatment in sarcoma or osteomyelitis. The only treatment was the course of sulfathiazole. The possibility that the condition was xanthomatous cannot be overlooked, for silent bone destruction and complete reconstruction can occur in this disease.

Fabella (*Sesamum genu superius laterale*). Ingemar Hessel. *Acta radiol.* 27: 177-196, March 30, 1946. (In German.)

Fabella is a periarticular sesamoid bone. It is the only sesamoid bone which occurs at the back of the knee in man. After reviewing the world literature, the author reports in this paper his own observations based on the radiographic examination of 942 knee joints of 471 patients ranging in age from two months to eighty-six years. A fabella was found in 154 knees, an incidence of 16.3 per cent. In 85.5 per cent of the patients the anomaly was bilateral. No sex difference and no preference for the left or right side of the body could be detected, nor could any definite relationship to arthritic processes of the knee joint be established. Fractures of fabellae have been reported as a rare occurrence. The author reports three such cases in his material.

F. ELLINGER, M.D.

Herniation of the Intervertebral Disc. A Systematized Technique for the Investigation and Treatment of Lumbosacral and Low Lumbar Lesions. I. Joshua Spiegel. *Illinois M. J.* 89: 188-196, April 1946.

The purpose of this article is to discuss the method by which patients with true herniated disks are screened from the numerous patients with low back pain who are admitted to a large Army neurosurgical center. The author gives the list of questions and tests used to make the differential diagnosis in his service.

Disk lesions are not limited to any specific age group. They occur most commonly in male patients in the physically active age group between fifteen and forty-five.

In true disk cases, unless the onset is especially severe, medical assistance is not usually sought with the first attack. The average interval between the onset of symptoms and arrival at a neurosurgical center was three years in the author's experience.

The history is usually episodic, each succeeding episode being generally more severe than the preceding one. The author gives several reasons to account for the episodic nature of the symptoms. If the posterior longitudinal ligament is not torn but only thinned out ahead of the herniated disk, it is quite conceivable that the herniated disk may gradually return to its normal position, with consequent remission of symptoms. A second injury will push the ligament posteriorly and symptoms will recur. In those cases where the posterior longitudinal ligament is actually torn and there is extrusion of disk material into the spinal canal, it seems possible that the herniated material may gradu-

ally work its way from one position to another in the canal, on one occasion producing exacerbation of the pain and on other occasions causing its remission. It is not likely that remission of symptoms can result from a return of the herniated disk to its normal position through a tear in the posterior longitudinal ligament. Another explanation for the episodic nature of the illness is that the spinal nerve on which the herniated disk impinges may slip to one side or the other of the herniated portion, with relief of symptoms. When the herniated mass moves once more and again impinges on the nerve, pain recurs. Finally, it is known that continued pressure on a nerve will eventually cause it to cease to function. This may explain a few cases of gradual diminution in pain. With recurrent trauma, the herniated mass moves again, the pressure is increased, and symptoms reappear.

About half of the patients in this series gave a definite history of injury to the back preceding the attack. The other half had no specific history of injury but many of them stated that symptoms were first noticed after prolonged periods of heavy exertion, such as military maneuvers or a period of hard manual labor.

The first symptom is usually low back pain. This pain may precede by years the onset of sciatic radiation, and is attributable to actual tearing or stretching of the posterior longitudinal ligament and the annulus fibrosus. The most frequent sites of radiation of pain are into the affected hip, the posterolateral aspect of the thigh, knee, leg, and ankle. Occasionally the pain is referred to the great toe or to the dorsolateral aspect of the foot and the outside toes.

Aggravation of the pain by coughing and sneezing is highly significant and generally indicates the presence of a space-occupying lesion, probably extradural, lying in the spinal canal. Pain may also be aggravated by certain movements. Some patients are most comfortable when standing. Bending forward may cause severe pain, as may any sudden movement of the back.

Paresthesias, such as tingling and burning sensations, are common. There may also be areas of numbness, the location of which is important in determining the site of the herniation.

The patient usually limps, as there is a tendency to favor the painful extremity. There may be a definite list of the body to the side of the lesion. A loss of the normal lumbar lordosis is common. Marked paravertebral muscular spasm may be present in the lumbar area. Commonly there is some tenderness to percussion over the spine in the involved area with radiation of the pain. Flexion of the spine usually produces pain, whereas hyperextension does not. Sciatic tenderness is not infrequent. By digitally compressing both internal jugular veins for a few seconds and increasing the intracranial pressure, the pain may be reproduced (Naffziger's sign). Extension of the leg with the thigh flexed may indicate the presence of irritation of the sciatic nerve (Lasègue's sign). The knee reflex is characteristically diminished in lesions involving the second, third, and fourth lumbar nerves. Diminution or absence of the ankle jerk is a fairly dependable sign of herniation between L4 and L5 or L5 and S1.

Flexion, abduction, external rotation, and extension of the femur are accomplished by placing the heel of the side being tested on the opposite knee and pressing outward on the knee of the affected side. In a true uncomplicated herniated disk syndrome no pain should result (fabere test).

Sensory loss is one of the most dependable signs of a herniated disk. With herniations at L5 and S1 the most frequent sensory loss is over the lateral aspect of the leg, the dorsolateral and plantar aspect of the foot, and the lateral three or four toes. With herniations at L4 and L5, the most frequent sensory loss is over the medial portion of the dorsum and sole of the foot and over the dorsal and plantar surface of the great toe.

Atrophy resulting from disuse because of voluntary guarding of the limb and actual muscular atrophy due to temporary or permanent destruction of the motor nerve to the muscle may be determined by careful measurement of the limbs at parallel points. In advanced cases of herniated disk, definite motor weakness may be demonstrable.

There are no pathognomonic x-ray findings in the disk syndrome. Narrowing of the intervertebral space can usually be seen in both the anteroposterior and lateral views of the spine, but this is not a consistent finding nor does it always indicate the presence of a herniated disk. Loss of the normal lumbar lordosis may be evident in the lateral view. Pantopaque studies require careful interpretation. One must look for true defects in the column rather than long, smooth defects, which are most frequently artefacts. Swollen nerve roots may also cause a defect in the column of oil. They may be visualized occasionally as hour-glass deformities, though these deformities may be due to central protrusion of the disk. In the more laterally placed herniation there may be no defect in the column of oil but the dorsal sleeve around the nerve root may be obliterated.

Orthopedic complications, such as spondylolisthesis, unstable lumbosacral articulations, and osteochondritis of the spine, may all be present. The possibility of fusing the lumbosacral articulation after removal of the herniated disk must be seriously considered when any of these complicating conditions is present.

All the cases of herniated disks in this series which were clinically and radiologically proved were treated surgically if the patient so desired. Of approximately 170 patients with herniated lower lumbar or lumbosacral disks, seen since January 1945, 45 were operated on. In 30 cases the herniation was at L5 and S1, 12 were at L4 and L5, 2 were at both levels, and 1 was at T7 and D1. In 33 cases there was immediate relief of radiating pain and gradual disappearance of low back pain. Six patients had immediate relief of radiating pain with persistence of mild low back pain. In 3 cases radiating pain improved but there was gradual complete return of the low back pain, and in 2 cases the low back pain was possibly worse following surgery. In the high dorsal disk case there was complete relief of symptoms. The follow-up period is too short to be entirely significant, but it is apparent that the radiating pain is cured much more regularly than is the low back pain.

BERNARD S. KALAYJIAN, M.D.

Sideswipe Fractures. LaRue S. Highsmith and George S. Phalen. *Arch. Surg.* 52: 513-522, May 1946.

A sideswipe fracture is a mutilating comminuted fracture of the left elbow sustained when the driver of an automobile has the elbow projecting from the window at the time his car is sideswiped by an oncoming vehicle. There is usually extensive soft-tissue damage with more or less avulsion of the posterior portion of the elbow. Associated damage to nerves and vessels makes this fracture difficult to treat and contributes to poor

results; amputation through the lower end of the humerus (at the fracture level) is sometimes necessary. But since the function of a prosthesis is never as good as that of even a badly damaged hand, this measure should be avoided if possible. A rather conservative débridement with conservation of as much bone as possible followed by fixation at right angles offers the best outlook, but considerable individualization is necessary. Secondary arthrodesis or arthroplasty may be advisable, and in some instances a pseudarthrosis at the humeral fracture site has given a fairly good functional result. Internal fixation is seldom practical because of infection and the high degree of comminution.

Seven cases are reported and roentgenograms are reproduced. All the authors' patients were soldiers, but in every instance the injury was sustained while the patient was on furlough, leave, or pass. The problem is therefore primarily a civilian one. The fracture could be largely prevented if the public were better informed as to its cause.

LEWIS G. JACOBS, M.D.

Injuries of the Elbow in Children. George W. Chamberlin. *Pennsylvania M. J.* 49: 733-735, April 1946.

After the forearm, the most common site of fracture in childhood is around the elbow joint. In a series of 86 consecutive cases of elbow injuries in children, it was found that supracondylar fractures were the most frequent. Separation of the median epicondyle of the humerus with or without dislocation of the bones of the humerus was second in order of occurrence.

Anatomically a child's elbow differs from that of an adult, and a knowledge of the time of appearance and fusion of secondary centers of ossification is important for a clear understanding of the mechanism which produces the various deformities following trauma. The cylindrical shaft of the humerus broadens, thins out, and bends forward as it approaches the elbow. The olecranon and coronoid fossae also weaken it and make it less resistant to fracture. In children under nine years, a line bisecting the capitellum at right angles to its base makes an angle of about 45 degrees with a line bisecting the long axis of the humerus. In the anteroposterior view, a line bisecting the long axis of the humerus will form a 10- to 15-degree "carrying angle" with the long axis of the ulna.

The four secondary centers of ossification for the lower end of the humerus appear at the following ages: capitellum, 11 months to 2 years; internal epicondyle, 5 to 6 years; trochlea, 9 years; external epicondyle, 13 years. The capitellum, trochlea, and external epicondyle fuse at about the 14th year and unite with the shaft at the 15th to the 17th year. Fusion of the internal epicondyle occurs a little later. The secondary center of ossification for the head of the radius appears at the 5th year and fuses about the 17th or 18th year.

In adults a fall on the hand with the forearm extended may result in a posterior dislocation at the elbow. The same force in a child is more likely to cause a supracondylar fracture of the humerus. The line of fracture is most often oblique from above downward and from behind forward, just above the intracondylar line and through the olecranon fossa or foramen. The fragments may impinge upon the brachial artery or median nerve in the antecubital space.

Frequently there is associated with dislocation of the elbow in children a detachment of the median epicondylar epiphysis. The bony fragment of the epicondyle

may be easily overlooked within the joint space with resultant ulnar nerve paralysis and deformity. In 8 of the author's 9 patients with dislocation, separation of the median condyle occurred. In such cases an attempt at closed reduction should be made, as described by Schmier (*Surg., Gynec. & Obst.* 80: 416, 1945. *Abst. in Radiology* 46: 203, 1946), but in most instances open reduction is necessary.

Epiphyseal separation of the capitellum is not uncommon. It is frequently associated with fracture of the lateral condyle of the humerus. If the fragments are rotated, the carrying angle will be increased.

JOSEPH T. DANZER, M.D.

Fractures of the Os Calcis. J. C. Cherry. *Irish J. M. Sc.*, April 1946, pp. 122-125.

This paper on os calcis fractures illustrates well the value of a small series of cases with adequate follow-up. While the group studied actually numbers 7 cases (9 of a total of 16 cases having been excluded for various acceptable reasons), the uniformly poor results justify the author's criticisms, in so far as they demonstrate failure of the classical method of treatment (the Boehler technique) in the hands of an apparently very conscientious physician.

All of the patients were followed for at least four years, and one for as long as nine years, and all have some permanent partial disability—a stiff foot, usable but with pain and swelling at the end of a day's work.

The author believes that the reduction of the "salient angle," no matter how accurate, is never maintained and that the end-result in nearly all cases is the same as before treatment, and reproductions of films prove his point.

Certain drawbacks also attend the method: (1) the danger of sepsis when a pin is used for traction through the traumatized bone; (2) the frequent occurrence of osteoporosis, whether the result of disuse atrophy or heavy traction, (3) the severe wasting of the muscles. That the osteoporosis is not attributable to the original injury is indicated by its absence in cases in which a plaster cast is used and walking is permitted.

The author also goes into the financial aspects of the cases and their ultimate outcome, and clearly demonstrates that the compensation does not nearly meet the amount of disability. SYDNEY F. THOMAS, M.D.

Diagnostic Problems in Fractures of the Foot and Ankle. Daniel Wilner. *Am. J. Roentgenol.* 55: 594-616, May 1946.

The various areas of the foot are discussed in detail from the point of view of pitfalls in the diagnosis of fractures. Since the presentation is in almost outline form, it is not easily abstracted, but some of the points made by the author may be noted.

In the metatarsus, persistent epiphyseal lines and accessory bones must be differentiated from fractures. Accessory bones, or ossicles, are probably the most common source of confusion. A differential feature is the presence, on every surface of the ossicle, of cortex, while this will be absent from at least one surface of a fracture fragment. Since accessory bones are usually bilateral, examination of the opposite foot for comparison may be useful. Double or bipartite sesamoids are of quite frequent occurrence and special views may be required for their demonstration.

The os peroneum lies along the external border of the

cuboid bone. It varies greatly in size. It may be mistaken for a chip fracture of the os calcis or cuboid.

Isolated fractures of the scaphoid bone are rare. The os tibiale externum (accessory scaphoid), seen along the medial margin of the proximal articulating end of the scaphoid, is quite often mistaken for fracture. The talonavicular ossicle is uncommonly seen as a small fragment of bone on the dorsum of the foot between the upper edges of the astragalus and the scaphoid. It is difficult at times to differentiate from a chip fracture or a localized osteoarthritis.

Compression fractures of the astragalus are rare and hard to diagnose. In a profile view, a compression fracture may be confused with a normal low astragalus. The anterior superior portion of the astragalus may present a dorsal projection which may be fractured. The posterior projection of the astragalus may also be fractured, and such fractures must be distinguished from the os trigonum, which may be present here as a separate center. Comparison with the opposite foot will be useful in differentiation. Osteochondritis dissecans, characterized by localized aseptic necrosis of cartilage and bone adjacent to it, has occurred in the astragalus and can be mistaken for fracture.

The os calcis is fractured more frequently than any of the tarsal bones. Lateral and superior-inferior views are essential for diagnosis. Fracture of the sustentaculum is best visualized by an oblique view of the ankle in 45 degrees internal rotation. Spurs on the plantar surface of the os calcis may appear to be fractured when actually they are connected by fibrous tissue not visible on the roentgenogram. A small ossicle is sometimes present at the anterior superior extremity of the os calcis. This is also a frequent site of chip fracture.

Post-traumatic ossifications of torn ligaments at the lower end of the tibia must not be mistaken for avulsion fractures. Other sources of confusion are peri-arthritis deposits, calcifications in veins and arteries, and the os subtibiale, an accessory ossicle sometimes occurring below the internal malleolus.

A fracture of the lower end of the fibula may escape detection unless the ankle is angulated slightly to separate the fibula from the shadow of the tibia. Post-traumatic ossifications of the calcaneo-fibular ligament or the peronei tendons may occur below the lower end of the fibula a few weeks after injury.

Many drawings and roentgenograms are shown to illustrate the various accessory bones of the foot and the other abnormalities encountered in the foot and ankle. CLARENCE E. WEAVER, M.D.

GYNECOLOGY AND OBSTETRICS

Some Interesting Observations in Routine Pregnancy Studies. L. A. Fortier, T. T. Gately, and P. A. Kibbe. *New Orleans M. & S. J.* 98: 456-458, April 1946.

Since 1936 the authors have been doing x-ray pelvimetric studies, by the method of Ball and Marchbank, to decide upon the feasibility of normal labor. They find that, with the two films required with this method, they can determine the type and size of the maternal pelvis, the presence of bone or joint lesions and, relative to the fetus, the number, position, size, and probable term.

Reports are presented of one case of hydrocephalus, one case of anencephalic monster, and one case of spina bifida all demonstrated prenatally. In a fourth case

there was poor visualization of the fetal bones in repeated examinations during the course of pregnancy, which phenomenon was found at delivery to be due to osteogenesis imperfecta.

BERNARD S. KALAYJIAN, M.D.

Value of Antenatal Radiological Pelvimetry. (A Comparative Survey of the Prediction and Event in 300 Successive Pelvimetric Studies at Queen Charlotte's Maternity Hospital.) E. Rohan Williams and Leonard G. Phillips. *J. Obst. & Gynaec. Brit. Emp.* 53: 125-139, April 1946.

This paper is an attempt to assess the reliability of prediction of the course of labor from antenatal radiological examination alone. It is based upon a study of 300 pelvimetric cases, with a careful follow-up study in each instance.

Forty-nine patients were delivered by cesarean section; in 42 of these, the prediction could not be tested. Ten of the 49 patients had had previous cesarean section. Of the 222 patients delivered without any manifestation of disproportion, 200 (90 per cent) were predicted as likely to have delivery without disproportion. In 51 of 54 cases (94.4 per cent) in which there was abnormal delivery due to disproportion, the prediction was "abnormal or difficult delivery." In the entire series of 300 cases, the prediction was "wholly correct" in 83 per cent of the 253 assessable cases and "substantially correct" in 90.11 per cent, the difference between "wholly correct" and "substantially correct" being explained by the inclusion in the "substantially correct" figures of those cases with forceps-aided deliveries but without signs of disproportion during labor. The predictions which proved erroneous were, almost without exception, unduly pessimistic and therefore did not lead to obstetric tragedy but rather ensured added watchfulness in patients whose pelvis could not be regarded as functionally ideal in shape or in size, qualitatively or quantitatively, for childbearing.

Roentgen Diagnosis of Placenta Praevia Without Contrast Material. Vincent W. Archer and Norman Adair. *South. M. J.* 39: 297-301, April 1946.

The authors use the method of Ball and Golden (*Am. J. Obst. & Gynec.* 42: 530, 1941) for the demonstration of placenta praevia. Roentgenograms of the pelvis are made in the anteroposterior and lateral positions with the patient standing, especial care being taken to avoid rotation in either view. Fourteen- by seventeen-inch films are used, with the Potter-Bucky diaphragm and 4.0-mm. Al filter. For the lateral view, the central rays are directed through the superior border of the acetabulum. For the anteroposterior view, the patient stands with her back against the x-ray table; the position of the tube is not changed.

With vertex presentations the head is normally in the mid-line in both the lateral and the anteroposterior view, dropping slightly below a line between the promontory of the sacrum and the upper border of the symphysis in the last ten or twelve weeks of gestation. In the experience of the authors, placenta praevia is definitely eliminated by such a picture. If, however, there is deviation of the head from the mid-line in either view, or failure of the head to dip into the pelvis as the pregnancy advances, some type of pelvic mass is indicated.

Four illustrative cases are recorded. In the first, the

head was above the promontory-symphysis line and displaced posteriorly in the lateral view, though it lay in the mid-line in the anteroposterior film. The roentgen diagnosis of placenta praevia was proved at operation—low cesarean section. In the second case, because of severe bleeding, only an anteroposterior view was obtained. This showed a marked deviation of the head laterally. Placenta praevia was proved at cesarean section. In the third case there was lateral and anterior displacement of the head, but it dipped below the promontory-symphysis line. A roentgen diagnosis of marginal placenta praevia was made. A Braxton-Hicks version was done and a macerated fetus was delivered by breech extraction. The fourth patient was examined with an opaque medium in the bladder. The fetal head was shown to be displaced laterally and anteriorly and it did not dip into the pelvis. A roentgen diagnosis of placenta praevia was made. Thirty-seven hours later a dead fetus was delivered spontaneously.

The authors conclude that the position of the placenta within the pelvis can be accurately determined by the simple non-instrumental technic described, but that the indications for cesarean section remain a clinical problem. Their opinion is that, with failure of the head to dip below the promontory-symphysis line, labor will be difficult in the majority of instances and the possibility of a viable fetus quite remote. Cesarean section would therefore seem to be indicated under these conditions.

BERNARD S. KALAYJIAN, M.D.

THE GENITO-URINARY SYSTEM

Urography on Children After Administration of the Contrast Substance by Mouth. Aage Friese-Christiansen. *Acta radiol.* 27: 197-201, March 30, 1946. (In English.)

Because of the well known difficulties of intravenous urography in infants and small children, the author uses oral administration of hippodin (hippuran). Preparation is as for other methods and dosage is 10 gm. for children under ten years of age and 15 gm. for those over ten. The optimum time interval before roentgenographic examination has been found to be three to four hours. Shorter intervals add difficulty in interpretation because of contrast medium in the intestine. Of the 16 reported examinations, satisfactory roentgenograms were obtained in 10. In none of the cases was nausea or vomiting encountered, the only difficulty being the disagreeable taste of the drug.

ELIZABETH A. CLARK, M.D.

Recognition of Ureteropelvic Obstruction. Donald M. Beard. *J. M. A. Georgia* 35: 107-111, April 1946.

Determination of the exact cause of ureteropelvic obstruction producing hydronephrosis may not be possible from pyelographic studies alone, though the hydronephrosis itself is easily recognized. The author reviews 51 cases of ureteropelvic obstruction studied in an Army general hospital. The most frequent etiological factor was aberrant or accessory renal vessels—27 cases. This incidence is higher than commonly reported and probably is related to the relative youth of the patients. These vessels usually supply a small area of the lower pole and may arise from the aorta or the main renal vessels. The pulsations of the vessels are thought to interfere with the peristalsis of the ureter, producing the obstruction. The vessel may cross the pelvis, the

ureteropelvic junction, or the ureter. Since aberrant vessels may be present without producing hydronephrosis, care must be taken not to overlook the true cause of the obstruction in such cases.

Stricture of the ureteropelvic junction was found in 3 cases. Most observers regard this as congenital in origin, but others believe that chronic inflammation of the ureter and ureteropelvic junction may produce the stenosis. Some cases are known to result from trauma.

Hypertrophy of the circular muscular layer of the ureter was found to be the cause of ureteropelvic obstruction in a single case. In 4 cases, fibrous bands produced obstruction. These are thought to be a residual of perinephritic infection, but may be associated with other etiologic factors.

High insertion of the ureter was found in 10 cases, but this was believed to be the result of the hydronephrosis rather than the cause in most instances. Seven of these 10 kidneys were horseshoe kidneys and 3 were ectopic kidneys.

Pedunculated tumors of the pelvis or tumors near the ureteral orifice in the renal pelvis may cause obstruction in rare instances. Various combinations of the above-named causes accounted for the obstruction in 6 of the author's cases. In many instances, only at operation was it possible to determine exact etiologic factors.

The radiographic appearance may be quite characteristic in some instances. The renal pelvis is usually uniformly and symmetrically enlarged with the inferior border of the hydronephrotic sac smooth and even. The ureter is often not seen to enter the pelvis. When an aberrant vessel crosses the pelvis, a characteristic crescent-shaped deformity is produced by the presence of the opaque media in that portion of the pelvis distal to the obstructing vessel. When the vessel crosses the ureter distal to the ureteropelvic junction, the dilated ureter can be seen above the obstruction. Hypertrophy of the circular muscular layer of the upper ureter will usually produce a dilated renal pelvis which has not lost its normal funnel shape. Abnormally high insertion of the ureter can usually be determined, but is not commonly a factor in obstruction unless associated with other congenital anomalies. Lesions of the renal pelvis producing obstruction usually produce a filling defect in the pyelogram. BERNARD S. KALAYJIAN, M.D.

Diagnosis of Perinephric Abscess. Lloyd G. Lewis. S. Clin. North America 26: 357-367, April 1946.

Correct evaluation of the history, physical signs, laboratory data, and x-ray findings should lead one to the diagnosis of perinephric abscess in the majority of instances. The diagnosis is often missed, however, because of sole reliance upon the radiologic picture, not correlated with the symptoms and signs.

A large percentage of perirenal infections occur secondary to renal disease, such as calculus, renal carbuncle, and pyonephrosis. Carbuncles, furuncles, or even superficial skin infections are frequently the source of infection when *Staphylococcus aureus* is the infectious agent. Colon bacilli may gain entrance to the kidney from the bowel by way of the lymphatics, but most frequently these organisms are found secondary to ureteral obstructions and calculus. Streptococcus abscesses may occur following dental, tonsillar, or sinus infections. The so-called non-pathogenic bacteria invade the kidney following retrograde cystoscopy, ureteral catheterization, and renal surgery.

The first symptoms noted are malaise and loss of appetite, usually accompanied by fever, which may be low grade or intermittent or, when pyelonephritis is present, markedly elevated and spiking. Pain may be present but is not distinctive. Urological symptoms such as frequency, urgency, and dysuria are conspicuously absent unless the perinephric infections occur secondary to urolithiasis, pyelonephritis, or urological surgery.

Flexion of the thigh due to psoas spasm is a frequent physical finding. Signs referred to or from the diaphragm may be found. Costovertebral angle point-tenderness is usually present on the affected side. Urinalysis may be entirely negative and the urine may even be sterile to culture.

The roentgenogram may show curvature of the spine toward the affected side. The psoas muscle shadow may be obliterated, bulged outward, or of normal appearance. Pyelograms are most difficult to interpret. The diagnosis of a renal cortical tumor or renal cyst is frequently made because of distortion or obliteration of the calices. The kidney may be displaced or compressed. The only constant x-ray finding in perinephric abscess is fixation of the kidney, and for this reason upright films should be made in all suspected cases.

Six excellent illustrative cases are recorded in detail, with fair illustrations. SYDNEY F. THOMAS, M.D.

Prostatic Calculi. Neil S. Moore and Earl A. Powell. J. Missouri M. A. 43: 245-248, April 1946.

From a study of the literature, the authors believe that prostatic calculi are more common than is generally believed. They are of two types: endogenous or true prostatic calculi and exogenous. Of the endogenous group, the most important are those occurring in pockets of an otherwise non-hypertrophic gland.

The etiology of endogenous calculi is unknown. The most generally accepted theory is that they begin with a nucleus of corpora amylacea, blood clot, clump of bacteria, epithelial debris, or pus, upon which are deposited phosphate and carbonate salts. Exogenous prostatic calculi are formed outside the prostate, possibly as far distant as the kidney, and come to rest in the prostatic urethra.

Prostatic calculi may occur at almost any age, but the majority are found in the fourth, fifth, and sixth decades. They may be discovered incidentally in association with almost any prostatic disease, having given no clinical evidence of their presence. It is the authors' opinion that calculi appearing in a carcinomatous prostate are purely coincidental and not necessarily an etiologic factor. Endogenous prostatic calculi vary in size from a mustard seed to 2 cm. in diameter, and in number from a few to many hundred. Sooner or later, their presence will set up an inflammatory process in the gland.

Though some cases are symptomless, in others symptoms are present, varying from slight local irritation and urinary disturbance up to abscess formation, with chills and fever and pain in the rectum or perineum. The commonest symptoms are dysuria and sometimes a urethral discharge which, on examination, reveals only pus cells.

The diagnosis may be suspected on rectal examination or on the passage of instruments into the posterior urethra, which will produce severe pain. Positive diag-

nosis is dependent on roentgen examination. The ordinary roentgenogram made with the tube over the mid part of the abdomen will throw the shadow of the prostate beneath the symphysis pubis and may thus obscure any calculi present. If the patient is placed on the table with a pillow under the dorsal vertebrae, and the rays are directed down the pelvic strait, the prostatic shadow will fall within the pelvic cavity and calculi will be easily recognized.

Treatment depends upon the severity of the symptoms and the age of the patient. If the symptoms are mild, occasional irrigation and perineal heat will be sufficient. A prostate filled with stones should not be massaged, as such treatment merely grinds the calcareous deposits around in the gland, causing further irritation. If the symptoms are severe, and obstructive signs are present, the gland may be removed completely. If the patient is young and there is no sign of obstruction, a suprapubic or perineal prostatolithotomy may be done. Transurethral resection is a useful procedure in cases in which a stone may be pocketed in the median or lateral lobes near the urethral mucosa.

Six case histories are recorded.

BERNARD S. KALAYJIAN, M.D.

THE BLOOD VESSELS

The Innervation of the Veins: Its Role in Pain, Venospasm, and Collateral Circulation. A. de Sousa Pereira. *Surgery* 19: 731-742, May 1946.

Investigations have shown that the nerves of the veins, arteries, and lymphatic vessels are responsible for much of the pain in cancer. It is also known that denervation of both arteries and veins is followed by cessation of all sensation of pain and by dilatation of the vessels. There is a more rapid and extensive development of collateral circulation in all three types of vessels following denervation.

This communication, in addition to reviewing the literature, reports further work directed toward clarifying the pathways taken by the afferent and efferent vasomotor nerves in supplying the peripheral veins. Some difference of opinion exists as to whether there is termination of pain fibers in both the adventitia and the intima of the veins. Mechanical or chemical stimulation of the adventitia of the femoral vein was found to induce a diffuse pain that could be relieved either by anesthetizing the outer layer just above the point of stimulation or by anesthetic blocking of the lumbar sympathetic chain. Irritation of the intima of the femoral vein also induced pain, and intraluminal injection of one per cent novocaine solution abolished pain in thrombophlebitis, thus showing that there are pain fibers in both adventitia and intima. These experiments form the basis for the conclusion that both afferent and efferent fibers reach the peripheral veins and pass through the sympathetic chain in doing so.

The relation of venospasm to pain was investigated in 2 cases, one of acute phlebitis and one of thrombophlebitis of the internal saphenous vein. Venographic studies in the case of acute phlebitis showed the lower half of the saphenous in the leg, while the upper half was not demonstrable. A second venogram, obtained forty-five minutes after intravenous injection of novocaine, showed the entire involved segment. Pain was completely relieved for two hours, after which it returned, but at a lowered intensity. Complete relief was

then obtained by a sympathetic block at the level of the third lumbar ganglion. In the case of thrombophlebitis, venograms failed to show any part of the saphenous in the leg. Two hours after blocking the third lumbar sympathetic ganglion with novocaine, a repeat venogram visualized the vein in the lower two thirds of the leg; the upper third was still obliterated, but there was increase in the development of collateral venous circulation. Twelve minutes after the sympathetic block, pain disappeared and was absent for twenty-four hours. Slight recurrence of pain was relieved by a second anesthetic block of the sympathetic chain. Since the venous vasodilatation and the relief from pain lasted for a longer period than the action of the anesthetic, it seems logical to conclude that in these cases venospasm played a role in the mechanism of pain arising in the veins. These investigations show that interruption of the sympathetic chain relieves the pain in phlebitis and thrombophlebitis.

The author also showed that repeated anesthetic blocks of the lumbar sympathetic chain (second, third, and fourth lumbar nerves) in phlebitis and thrombophlebitis lead to dilatation of the veins of the legs, and to improvement in the collateral venous circulation. In 2 other patients with thrombophlebitis he showed that perivenous sympathectomy of the femoral vein results in relief of pain and amelioration of vasomotor disturbances. There was also an increase in the collateral venous circulation. In a third series, resection of the third and fourth lumbar sympathetic ganglia and trunk was done. A manifest improvement in the existing thrombophlebitis and increase in the collateral circulation of the lower limbs followed the operation in each of two patients.

Clear reproductions of venograms are included.

J. E. WHITELEATHER, M.D.

Angiography—An Evaluation of Its Usefulness. A. H. Blakemore. *S. Clin. North America* 26: 326-342, April 1946.

Technics have been evolved making the safety of angiography in any region entirely commensurate with its diagnostic importance in given instances. Thus, while cerebral angiography should not be employed on the slightest provocation, it is possible, when there is a serious doubt as to diagnosis, to visualize the cerebral vessels with safety, to rule out, for example, the presence of an arterial aneurysm or to localize a traumatic arteriovenous fistula.

Aortography according to the technic of Robb and Steinberg, in which 70 per cent diodrast is introduced into a vein in the right arm, gives a high degree of precision in the diagnosis of cardiovascular disease. A film obtained by this method in a case of the tetralogy of Fallot is reproduced. Retrograde opacification of the aorta by way of the right common carotid or right brachial artery will demonstrate an aneurysm or patent ductus. dos Santos and his associates inject a contrast medium directly into the ascending aorta. The author found this method useful in checking the degree of clotting in aneurysms when employing the electrothermic method of coagulation. He shows good examples of the procedure.

Warning concerning the use of arteriography for revealing the adequacy of collateral branches around areas of obstruction is given. Arteriography for this purpose is not only dangerous, but, because of the superimposed

vasospasm, is not particularly informative. Other methods are equally accurate for determining the adequacy of collateral circulation.

The author feels that angiography is probably most useful in arteriovenous fistulae, whether acquired or congenital. He also demonstrates the usefulness of angiography in determining the patency of arterial anastomoses with vein grafts with vitallium cuffs.

Venography is mentioned briefly. The author is not in favor of using it in cases of acute thrombophlebitis or phlebothrombosis in the extremities. He finds it most useful in determining the adequacy of the deep venous system in old post-phlebitis cases involving the lower extremity. [The abstractor feels that venography is of little additional value, except in cases where the clinical circulatory tests are masked by some overlying skin changes or marked soft-tissue damage by ulceration and surrounding edema. In review of over 50 venograms of the lower extremity, and 5 of the arm, so little additional information was gathered that the procedure

has been used less and less. Homans, an early advocate of venography, states that results of the procedure have been increasingly "disappointing" (New England J. Med. 231: 51, 1944).] SYDNEY F. THOMAS, M.D.

An Improved Method of Arthrography. A. Blaustein. *Canad. M. A. J.* 54: 491-492, May 1946.

The author has devised a simple apparatus for arthrography of the knee joint. It consists of a miniature oxygen tank with an airflow control gauge attached, a 100-c.c. syringe and a 3-way stopcock, a glass filter, and some rubber tubing, assembled on a portable wooden stand. The apparatus delivers a controlled measured amount of filtered, pure oxygen into the knee joint.

For routine arthrography of the knee, anteroposterior and lateral films are made; also an anteroposterior film over a curved cassette with the knee flexed 30 degrees, and spot films on either side of the patella.

MORRIS IVKER, M.D.

RADIOTHERAPY

NEOPLASMS

Supervoltage Radiation: Review of the Cases Treated During an Eight Year Period (1937-1944 Inclusive). George W. Holmes and Milford D. Schulz. *Am. J. Roentgenol.* 55: 533-554, May 1946.

During the eight-year period covered by this report, a total of 1,835 cases were treated by supervoltage irradiation (1,200 kv.). The generator was of the Van de Graaff constant potential type. The output of this generator at 1,200 kv. and 0.5 ma., with filtration of 2 mm. lead, 5 mm. copper, and 2 mm. aluminum, is 45 r per minute, measured in air, at 70 cm. distance. The depth dose at 10 cm. below the surface, with a field of 100 sq. cm., is about 52 per cent of the surface dose. A dose of 3,000 r at that depth can be administered through two opposing portals, at a daily rate of 300 r, without producing more than a mild erythema.

In carcinoma of the tonsils, supervoltage therapy gave somewhat better results than irradiation at 200 kv., and it was felt that there was an added advantage in that the dose could be delivered through a single lateral field without significant skin damage and with less discomfort to the patient. A similar advantage may exist in laryngeal cancer, though the results in the present small series were approximately the same as with 200 kv. In cancer of the oral cavity, nasopharynx, and accessory sinuses, also, the survival rate was about the same as with the lower voltage.

In carcinoma of the lung supervoltage radiation was found to be worth while for palliation, and in a fair percentage of cases life was prolonged. The oat-cell carcinomas showed the best percentile survival. In other types, surgical treatment is recommended where there is a chance of cure.

In carcinoma of the esophagus there was no evidence that supervoltage radiation increased the survival time over the older methods; nor was any permanent benefit effected in carcinoma of the stomach. In carcinoma of the rectum it is believed that a better selection of cases, with a tumor dose up to 5,000 r, would result in some five-year cures, and in some cases might obviate the necessity for colostomy.

Except for Wilms tumor, neoplasms of the kidney do not respond to irradiation, and no evidence was obtained of any superiority of supervoltage therapy in this group. The earlier results of supervoltage irradiation in carcinoma of the bladder at the authors' clinic have been reported previously (*Radiology* 41: 371, 1943). The former dose of 5,000 r has now been reduced to 3,000 r at the site of the tumor. The maximum tolerance dose to the bladder and rectum seems to be between the two figures. No post-irradiation strictures occurred. Observations on 196 cases seem to show that supervoltage irradiation is an excellent palliative measure, that it prolongs life, and that in a small percentage of cases it results in permanent cure.

From 1938 to 1941, supervoltage radiation of carcinoma of the cervix was given through three fields, one anterior and two posterior, 3,000 r, measured in air, being given to each. The daily dose was 400 r; the estimated dose at the site of the tumor was 5,000 r. Subsequently, only two fields were used; the total dose to each was 3,000 r, but the daily dose was reduced to 300 r. The estimated dose at the site of the tumor was 3,000 r. All cases received radium as well as roentgen treatment, the dosage being between 3,000 and 5,000 mg. hr. Comparison of life expectancy in carcinoma of the cervix receiving supervoltage irradiation with those treated with 200 kv. radiation shows a definite increase in percentage surviving more than one year with the higher voltage. After five years the two curves begin to run parallel. There was an absence of severe skin damage and a decrease in roentgen sickness.

Perhaps the most important advantage of supervoltage radiation is the lower incidence of serious skin damage. The authors believe that when the cases are properly selected, supervoltage radiation offers the patient a slight, but definite, increase in life expectancy and that some of the unavoidable bad effects of irradiation with lower voltage can be eliminated. The use of supervoltage radiation should be encouraged in carcinoma of the cervix, carcinoma of the bladder, carcinoma of the lung, embryoma of the testicle, carcinoma of the tonsil, localized lymphoma, Ewing's tumor, and carcinoma of the rectum.

CLARENCE E. WEAVER, M.D.

Cancer of the Cervix: A New Technique for Interstitial Implantation of Radium into the Parametrium. E. Eugene Covington. *Surg., Gynec. & Obst.* 82: 512-517, May 1946.

The author describes his method of interstitial implantation of radium into the parametrium in cancer of the cervix. He has used this additional irradiation in 100 cases and believes preliminary results are better than with intracavitary radium and external roentgen therapy alone, which furnish only a negligible amount of radiation to the pelvic nodes. His method increases the dose delivered to the cervix and considerably increases the dose to the parametria and lymph nodes.

The first radium treatment of 3,600 mg. hr. is divided into 2,160 mg. hr. by tandem in the uterine canal and 720 mg. hr. into each lateral vaginal fornix. Roentgen therapy (400 kv.) is started a few days later—2,000 to 2,400 r to each of four pelvic fields over a four-week period, for a tumor dose (at 10 cm) of 3,360 r. As soon as the roentgen series is completed, interstitial radium therapy by the new technic is instituted. Four small incisions are made as far laterally as possible, just through the vaginal mucosa, at the 2, 4, 8, and 10 o'clock positions around the cervix. A long Kelly clamp is then used to extend a long tract (2 to 4 cm.) into the parametria through each of the four incisions. Two rubber tandems containing 25 mg. of radium and two containing 20 mg. of radium are used, one in each tract. At the same time a long intrauterine tandem containing 60 mg. is inserted in the uterine canal. These are all left in twenty-eight hours. This gives a second dose of 1,680 mg. hr. to the uterine canal and 1,260 mg. hr. into each parametrium. The total irradiation directly to the cervix is thus increased, the distribution of radiation is more uniform, and, especially important, the dose to the parametria and pelvic lymph nodes is increased.

The author says that the insertion of the Kelly clamp to make the tracts into the parametria requires practice, but in his experience no immediate complications have arisen. He practised on cadavers before attempting the procedure in a patient. This method of insertion he regards as safer than the use of parametrial radium needles, and moreover, the heavier filtration (1 mm. Pt + 2 mm. rubber) decreases the tendency to necrosis where needles are used. The method is applicable in stages I, II, and III carcinoma of the cervix; its use in stage IV is dangerous and unwarranted. Other contraindications are fibrosis following the earlier treatment, and infection. JOHN A. COCKE, M.D.

Tumor of the Testicle: Analysis of One Hundred Cases: A Preliminary Report. E. C. Lowry, D. E. Beard, L. W. Hewit, and J. L. Barner. *J. Urol.* 55: 373-384, April 1946.

This is a preliminary report of 100 cases of tumor of the testicle. The patients were all soldiers treated at an Army General Hospital for a period varying from thirty to ninety days, and each case was subjected to a careful and thorough investigation. The tumors were classified as: benign teratoma (adult tissue only), 1; teratoma of mixed type, 24; embryonal carcinoma (without adult elements), 27; seminoma (without adult elements), 24; adenocarcinoma (without adult elements), 21; rhabdomyosarcoma, 1; fibroma, 1. One tumor was unclassified.

The method of treatment was the same, in general,

for all 100 cases, *i.e.*, orchiectomy after the technic described by Dodson (*Urological Surgery*. C. V. Mosby Co., 1944, pp. 659-682), followed by deep x-ray therapy. Irradiation was generally started as soon as the patient could be transported to the x-ray department, as a rule three to five days postoperatively. All treatments were given with the following factors: 200 kv. (G.E. Maximar), 15 ma., 50 cm. target-skin distance, 0.5 to 1.0 mm. Cu and 1.0 mm. Al filter added (half-value layer 0.9 to 1.35 Cu), 42 to 31 r per minute measured in air. The plan of x-ray therapy depended upon (1) the presence of metastases before treatment or a duration of symptoms for six months or longer, (2) no metastases at any time and a duration of symptoms of six months or less. Diagrams showing the portals of treatment for the two plans are reproduced. In both, 2 ports were treated daily, in rotation, each receiving 200 to 250 r (air dose) until 1,600 to 2,000 r (air dose) were delivered to each field. Fields were marked with indelible dye to facilitate setting up the case and to prevent overlapping. Adjacent fields were shielded with lead plates to avoid excessive irradiation. The umbilicus was protected with a small lead button during the latter half of the treatment to this area. The penis and normal testicle were pulled to the opposite side in all cases when the inguinal region was treated.

Twenty-four patients upon admission had definite demonstrable metastases and in 2 other cases metastases developed during the stay in the hospital. Subsequent examination revealed metastases in 12 additional cases. In only a few of the cases with metastases did x-ray therapy produce an appreciable diminution in size or disappearance of the metastatic mass. In those cases which responded initially there was subsequent recurrence. Several cases showed definite advancement of the disease during the course of treatment. Fourteen patients in this group were dead at the time of the report, and an additional 8 were bedridden and dying from the disease.

Of the entire group of 100 patients, 68 were living and well at the time of the report without evidence of metastasis. The length of time that had elapsed since operation in these cases varied from a few weeks to three years. While x-ray therapy appears to have little if any actual curative value in cases where metastases have already occurred, the authors believe in giving these patients the benefit of the doubt for the palliative effects of x-ray and in some cases an apparent prolongation of life.

Management of Malignant Tumors of the Testis.

Eugene P. Pendergrass, George W. Chamberlin, Joseph Selman, and Robert C. Horn, Jr. *Am. J. Roentgenol.* 55: 555-574, May 1946.

This study is based on 43 patients, all of whom are definitely known to have had malignant tumors of the testis. Among these were 20 homologous tumors (18 seminomas and 2 embryonal carcinomas) and 15 heterologous tumors (13 malignant teratomas and 2 adult teratomas). Seventy-four per cent of all the malignant testicular tumors occurred between the ages of twenty and thirty-nine. Experience has shown that lumbar pain is a symptom of ominous significance. In 58 per cent of all the patients there was evidence of metastasis at some time during their illness: 80 per cent of those with metastases had retroperitoneal involvement; 54 per cent mediastinopulmonary, 25 per

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cent supraclavicular, 13 per cent inguinal, and 8 per cent osseous (rib and femur). For the discovery of metastatic lesions, particular reliance is put on frequent roentgen examination of the chest and urinary tract. Excretory urographic studies are extremely valuable in revealing retroperitoneal deposits.

At present, it is generally conceded that all patients with malignant testicular tumors should have the benefit of irradiation and orchiectomy. The following technical factors are considered as constituting "conventional" treatment during the period of this report: 100 or 200 kv., 0.5 mm. Cu or 1 mm. Cu plus 1 mm. Al filtration, 50 cm. or 80 cm. target skin distance, the total dosage being at least 800 r in air applied to the mid-abdomen either anteriorly or posteriorly and extending 10 cm. to each side of the mid-line. In more recent cases, as much as 1,600 r was given to abdominal fields anteriorly and posteriorly, and in some, the mediastinal and left supraclavicular regions were also included. In patients receiving preoperative irradiation, at least 1,000 r delivered to the testis is considered "conventional." In those patients free from demonstrable metastases on admission and receiving conventional therapy no statistically significant difference can be demonstrated in the five-year survival of patients with homologous and heterologous tumors. The most important factors in survival appear to be the histopathologic classification of the tumor, the presence or absence of metastases, and well planned radiotherapy.

In the absence of clinical metastases, treatment is given to fields planned so that the lymphatic drainage channels of the torso on either side of the mid-line of the body from the supraclavicular regions to the symphysis pubis, and the inguinal regions and pelvis are irradiated. The irradiation is started in the peripheral fields. When treatment of all the fields has been completed, they are again treated in the same order. Each field should receive a total dose of 1,600 r in air. If treatment is to be applied to the primary tumor, it should not be started until all of the other fields have received at least 1,000 r. Operation can be carried out at any time following completion of the roentgen therapy, either immediately or after a delay of a few days to three weeks. Simple orchiectomy is preferred. If the patient has clinical evidence of metastases, irradiation should be carried to the limit of skin tolerance in that area. If postoperative therapy is the method of choice, treatment should be given over the primary drainage areas first, followed by successive fields upward to include finally the left supraclavicular area, and downward to include the inguinal regions and pelvis.

In this series of 43 patients, the over-all five-year survival rate was 42 per cent. In those without metastases the rate was 71 per cent and in those with metastases on admission it was 30 per cent. No difference in end-results was demonstrated between preoperative and postoperative irradiation. This observation, the authors point out, is at variance with that in an earlier report which included a considerable number of cases in the present series (Am. J. Roentgenol. 46: 850, 1941. Abst. in Radiology 39: 123, 1942). At that time preoperative irradiation was believed to offer the greater opportunity of cure. It is now recommended that all patients with a malignant tumor of the testis should receive preoperative or immediate postoperative irradiation regardless of the presence or absence of evidence of metastases. CLARENCE E. WEAVER, M.D.

NON-NEOPLASTIC DISEASE

Treatment of Tinea Capitis with Roentgen Rays. George M. MacKee, Arthur Mutscheller, and Anthony C. Cipollaro. Arch. Dermat. & Syph. 53: 458-465, May 1946.

There is a nationwide epidemic of tinea capitis in the United States. No one knows the exact number of cases, but it has been estimated that there are over 5,000 in New York City alone. This epidemic has offered an opportunity to study the different methods of applying an epilation dose of x-ray to the scalp.

The Adamson-Kienboeck five-point method has been used for years and has stood the test of time. In some European dermatologic centers, however, three, four, and even seven points of irradiation are used. The chief criticism of the Adamson-Kienboeck method is that there is overlapping, so that some areas receive an x-ray dose almost double that of the center. In spite of this, permanent epilation has occurred in only a small number of cases. It is the opinion of the authors that the cause in these cases is probably to be found in improperly calibrated apparatus or faulty technic. They still prefer the five-point technic, though they describe a four-point epilation method which they have evolved.

In the authors' four-point method, a line is drawn from the anterior to the posterior hair line in the sagittal plane; the distance is bisected and marked with a skin pencil. Another line is drawn from one ear through the center point to the other ear. The patient is placed in a supine position and the head is rotated 90 degrees. A pointer 25 cm. in length is placed in the filter slot of the machine and centered midway between the ear and the apex of the scalp. A tongue blade is placed at the center point of the scalp pointing upward, and the tube is angled until the tongue blade bisects the pointer at the 12.5 cm. mark. The ear is bent forward and 300 r is given to the area, using 60 to 100 kv., no filter. The same technic is used for the other three areas.

Seventy-five patients who had tinea capitis caused by *Microsporum audouinii* were treated by this method. Almost all of them were cured in from four to eight weeks. The importance of the use of the adhesive cap and appropriate post-epilation treatment is mentioned.

While localized epilation is successful in some cases, the authors do not advocate it. In the event of failure, it is unsafe to apply a second epilating dose in less than six months.

JOSEPH T. DANZER, M.D.

Irradiation for the Elimination of Nasopharyngeal Lymphoid Tissue. Donald F. Proctor. Arch. Otolaryng. 43: 473-480, May 1946.

At the Hagerstown Clinic for the Prevention of Deafness in Children (described in a paper in the same issue of Arch. Otolaryng. pp. 462-472), irradiation of nasopharyngeal lymphoid tissue was carried out in 323 patients (981 treatments). Many of the patients had not finished their treatments at the time of the report, but 100 had complete eradication of nasopharyngeal lymphoid tissue, and 144 patients had satisfactory regression of such tissue, with clearing of the eustachian orifices. Ten patients showed no improvement, but only 2 of these had received more than two treatments.

Since irradiation produces its effects only over relatively long periods, it is difficult to evaluate results of therapy in a clinic which has been in existence only a little over two years. However, 19 patients with recur-

rent otitis media had remained well since treatment; 26 patients with chronic otitis media had had dry ears over a period of many months; 8 children with bronchial asthma ceased to have attacks, and 2 other children were greatly improved. Forty-three patients with unusually severe recurrent infection of the upper respiratory tract had remained relatively free from this condition for at least the preceding winter. Nine ears with severe impairment of hearing returned to normal,

and 268 ears showed definite improvement of hearing.

For the eight months preceding their report the authors had been using an applicator containing 50 mg. of radium salt with a filter of 0.3 mm. of Monel metal. The most effective dosage with this applicator was found to be "1 gm. twenty seconds" on each side of the nasopharynx; since the applicator contains only 50 mg., or 0.05 gm., the time required for this dosage is twenty times as long—400 seconds.

EFFECTS OF RADIATION

Distribution of Radiation in the Atomic Bombing of Nagasaki. John C. Larkin. *Am. J. Roentgenol.* 55: 525-532, May 1946.

This study is based on the clinical records of 95 patients in three hospitals in Nagasaki, who were still hospitalized six weeks after the bombing of the city. Some of the energy released was in the form of radiation, the remainder and greater part of the energy being released as heat.

In order to facilitate this study the patients were grouped according to the zone of the city they happened to be in at the time of the explosion. There were few survivors in zone 1 (within 1,000 meters of the center of the explosion). Zone 2 (1,000 to 1,250 meters) was the zone where survivors showed maximum irradiation effects. Those in zone 3 (1,250 to 1,500 meters) showed slight irradiation effects. In areas beyond 1,250 meters, severe superficial burns but practically no irradiation effects were found. Protection by walls or roofs of buildings played a part in reducing the irradiation effects. There were 9 people in concrete buildings in zone 2, 4 of whom had only mild evidence of roentgen sickness and no sign of burns. Twelve people in this zone, with less protection, suffered severe roentgen sickness—profuse vomiting, hematemesis, melena, and diarrhea. In zone 3 symptoms were much less severe and in the outer zone they were very slight. In no case was a typical erythema attributable to gamma radiation reported.

Superficial radiation effects (*i.e.*, ultraviolet, visible light, and infra-red) were by far the most widespread reactions, being found in all zones and as far as 2,500 meters from the radiation source. People in zones 3, 4, and 5 felt no heat but noticed burns several seconds after the explosion. Almost any article of clothing seemed to give them adequate protection. A single layer of clothing might give partial protection, but several layers would not be penetrated. The burned areas were always facing the radiation source. These effects were not due to gamma radiation. In all cases healing was rapid and complete.

Seventy-six per cent of persons in zone 2 and 22 per cent of those in zone 3 lost part of their hair. Ten out of 11 women in zone 2 whose menses had been regular and 9 out of 12 in zone 3 had amenorrhea after the bombing. In some instances, this may have been due to psychological factors.

Maximum depression of the white blood count was reached near the twenty-eighth day. The average count of 11 cases in zone 2 was 980. In zone 3 the average was 3,750. There was a normal count in a patient in zone 2 who was protected by a concrete roof. Patients who had combined irradiation effects and superficial burns died much earlier than those with pure irradiation effects. In the latter group the greatest number died at the end of the seventh week, demonstrating the delayed reaction to irradiation alone.

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